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Electric Power Annual
1988

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Cover Photo:

This skyline scene in Dallas, Texas, depicts electricity, which provides energy to light homes and shopping centers, and to run factories.

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1988

Energy Information Administration
Office of Coal, Nuclear, Electric and Alternate Fuels
U.S. Department of Energy
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Preface

The *Electric Power Annual* presents a summary of electric utility statistics at the national, regional and State levels. The objective of the publication is to provide industry decisionmakers, government policy-makers and the general public with historical data that may be used in forming various perspectives on electric issues that lie ahead.

Background

The *Electric Power Annual* is prepared by the Electric Power Division; Office of Coal, Nuclear, Electric and Alternate Fuels; Energy Information Administration (EIA); U.S. Department of Energy. The 1988 edition has been redesigned and expanded to provide a wider perspective of the electric power industry. The initial section now provides the reader with a profile of the electric utility industry and a review of key statistics for the year. New sections are introduced that present data on financial statistics, environmental statistics and electric power transactions. Subject matter reported in prior issues is included in sections on generating capability; net generation; fossil fuel statistics; and electricity sales, revenue and prices. In addition, the appendices provide supplemental data on production expenses and planned capability additions.

In order to achieve this broader scope, the level of detail has been reduced. Each section contains related text and tables and refers the reader to the appropriate publication that contains more detailed data on the subject matter.

Target Audience

"The Industry At A Glance" section, presents a profile of the electric power industry ownership and performance. The subject sections of the *Electric Power Annual* provide specific statistics related to the electric power industry. They contain a synopsis of the fuels and equipment used to produce electricity, the amount of electricity produced, the costs and sales of electricity, and related financial information.

In the private sector, the majority of users are researchers and analysts and ultimately the policy- and decision-making members of electric utility companies. Financial and investment institutions, economic development organizations interested in new power plant construction, special interest groups, lobbyists, electric power associations, and the news media will find the data in the *Electric Power Annual* useful.

In the public sector, the users include analysts, researchers, statisticians, and other professionals engaged in regulatory, policy, and program areas for Federal, State, and local governments. The Congress and other legislative bodies may also be interested in general trends related to electricity at State and national levels. Much of the data in this report can be used in analytic studies to evaluate new legislation. Public service commissions and other special government groups share an interest in State-level statistics. These groups can also compare the statistics for their States with those of other jurisdictions.

Coverage of Sources

Data published in the *Electric Power Annual* are compiled from two statistical forms filed monthly and six forms filed annually by electric utilities. These forms are: the Form EIA-759, "Monthly Power Plant Report"; the Federal Energy Regulatory Commission (FERC) Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants"; the Form EIA-860, "Annual Electric Generator Report"; the FERC Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others"; the Form EIA-767, "Steam-Electric Plant Operation and Design Report"; the Form EIA-861, "Annual Electric Utility Report"; the Department of Energy, Form IE-411, "Coordinated Bulk Power Supply Program"; and the Economic Regulatory Administration, Form ERA-781R, "Annual Report of International Electric Import/Export Data." A brief description of each of these forms follows. These survey forms are described in more detail in Appendix D, "Technical Notes."

The Form EIA-759 is used to collect monthly data on net generation; consumption of coal, petroleum, and natural gas; and end-of-the-month stocks of coal and petroleum for each plant by prime mover and fuel-type combination. Data are collected from all electric utilities that operate power plants (except those having plants solely on standby), approximately 800 of the 3,250 electric utilities in the United States.

The FERC Form 423 is a cutoff sample used to collect data on power plants with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts (approximately 225 electric utilities). This threshold was established by the FERC. Data collected on the FERC Form 423 include information on fossil fuels regarding quantity, quality, delivered price, origin, fuel type, supplier, and type of contract under which the fuels are purchased.

The Form EIA-860 is used to collect data annually from all electric utilities in the United States that operate power plants or plan to operate a power plant within 10 years of the reporting year. Information on electric generators is reported by approximately 900 electric utilities.

The FERC Form 1 is an annual survey of the major privately owned electric utilities having, in each of the last 3 consecutive years, sales or transmission service that exceeds any one or more of the following: (1) 1 million megawatthours of total sales, (2) 100 megawatthours of sales for resale, (3) 500 megawatthours of gross interchange out, or (4) 500 megawatthours of wheeling for others (deliveries plus losses). Financial statistics including income; taxes; depreciation and amortization; electric operating revenue; electric maintenance expenses; year-end balance sheets; and, general corporate information are reported on the FERC Form 1 by approximately 180 major privately owned electric utilities.

The Form EIA-767 is a survey of all operators of power plants with a fossil-fueled steam-electric existing or planned nameplate capacity of 10 or more megawatts. The Form EIA-767 is used to collect data annually on plant operation and equipment design (including boiler, generator, cooling system, flue gas desulfurization units, flue gas particulate collectors, and stack data). Approximately 320 electric utilities provide information regarding approximately 900 power plants on the Form EIA-767.

The Form EIA-861 is a survey of electric utilities in the United States, its territories, and Puerto Rico. The data from the Form EIA-861 that are contained in this publication are for the United States only. The survey is used to collect information on the production, sales, revenue from sales, and trade of electricity from approximately 3,250 electric utilities.

The Form IE-411 is an annual report supplied to the Department of Energy by the nine North American Electric Reliability Councils. These reports have been compiled from data furnished by the member electric utilities. The Form IE-411 provides the Department of Energy with information on regional plans of electric utilities for a 10-year period and is used for its peak-load information in this publication.

The Form ERA-781R is used to collect data annually from all public utilities or entities (subject to the authority of Part II, Federal Power Act) engaged in the export of electric energy across the international borders of the United States with Canada and Mexico. The information collected on the Form ERA-781R includes the volume of energy received by or delivered to holders of export authorizations and presidential permits, and the costs and revenue associated with these transactions.

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The Industry at a Glance

Electricity is vital to virtually every aspect of the national economy. Dependence on electricity is expected to expand in the future in the United States. Consequently, the role of the industry charged with the responsibility of producing electric power and maintaining electric power service in the United States is significant.

The first section of this chapter provides a profile of the electric power industry illustrated by graphs. The second section of this chapter continues that descriptive profile by summarizing pertinent statistics on various aspects of the industry for the year.

Industry Profile

The U.S. electric power industry is a combination of privately, publicly, federally, and cooperatively owned electric utilities. Economies-of-scale, the availability of capital, and social preference are three important factors in determining the form of ownership for a producer or distributor of electricity. Historically, privately owned electric utilities have been most successful in serving large consolidated markets where economies-of-scale afforded the lowest prices. However, publicly, federally, and cooperatively owned electric utilities all have a role in producing, transmitting, and distributing electricity.

The H.B. Robinson Nuclear Power Plant is owned by the Carolina Power and Light Company. This 665-megawatt pressurized water reactor, located near Hartsville, South Carolina, was the first commercial-size nuclear plant in the Southeast.

Investor-Owned Utilities. Investor-owned electric utilities are also referred to as privately owned electric utilities. Like all private businesses, the fundamental objective of a privately owned utility is to produce a return for investors. The privately owned electric utility distributes its profits to stockholders as dividends or reinvests the profits and any excess cash flow. They are granted service monopolies in certain geographic areas and are obliged to serve all consumers. As franchised monopolies, these utilities are required to charge reasonable prices, to charge comparable prices to similar classifications of consumers, and to give consumers access to services, under similar conditions. Most privately owned electric utilities are operating companies that provide basic services for the generation, transmission, and distribution of electricity. The majority of privately owned utilities perform all three functions. Some companies have assumed additional functions related to their businesses, such as energy development; overall such activities are minor. Although privately owned electric utilities operate in all States except Nebraska, Hawaii is the only State in which all electricity is supplied by privately owned companies. The desire for economies-of-scale has decreased the number of privately owned electric utilities from about 4,000 in the 1920's to about 270, or approximately 8 percent of the total number of electric utilities. Nonetheless, privately owned electric utilities currently account for more than 75 percent of all U.S. electric utility generating capability, generation, sales, and revenue.

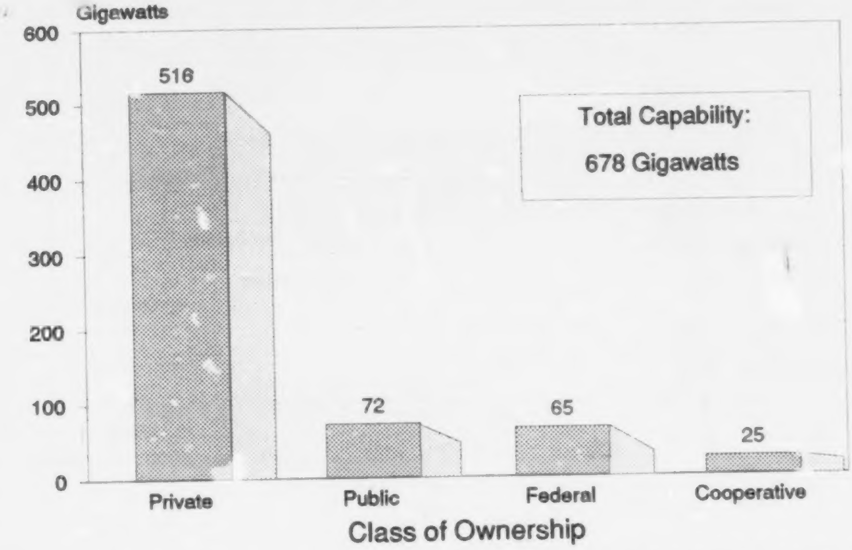
Publicly Owned Utilities. These utilities are nonprofit local government agencies established to serve their communities and nearby consumers at cost, returning excess funds to the consumer in the form of community contributions, economic and efficient facilities, and low rates. Publicly owned electric utilities (which number approximately 2,000) include municipals, public power districts, State authorities, irrigation districts, and other State organizations. Most municipal utilities simply distribute power, although some larger ones produce and transmit electricity as well. They obtain their financing from municipal treasuries and from revenue bonds secured by proceeds from the sale of electricity. Public power districts and projects are concentrated in Nebraska (which has no privately owned electric utilities), Washington, Oregon, Arizona, and California. Voters in a public utility district elect commissioners or directors to govern the district, independent of any municipal government. State authorities, like the New York Power Authority or the South Carolina Public Service Authority, are agencies of their respective State governments. Irrigation districts may have still other forms of organization. In the Salt River Project in Arizona, for example, votes for the board of directors are apportioned according to the size of landholdings.

Federal Power. Power produced by federally owned utilities is not generated for profit. Most of the electricity produced is sold to publicly and cooperatively owned electric utilities, and other nonprofit entities as required by law. The goal of all Federal producers is to provide power at the lowest possible cost consistent with sound business principles. The Federal Government is primarily a producer and wholesaler of electricity, rather than a distributor to ultimate consumers. These wholesale producers include the U.S. Army Corps of Engineers, the Bureaus of Indian Affairs and Reclamation within the U.S. Department of Interior, the Alaska Power Administration, the Tennessee Valley Authority, and the International Water and Boundary Commission within the U. S. Department of State. The electricity produced by federally owned utilities is marketed by the five power marketing administrations of the U. S. Department of Energy: Alaska, Bonneville, Southeastern, Southwestern, and Western Area. The Alaska Power Administration generates and markets electricity. These power marketing administrations operate in all States except those in the Northeast, the Upper Midwest, and Hawaii.

Electric Cooperatives. Electric cooperatives are owned by their members and are established to provide electricity to the members. These electric utilities operate in rural areas with a lower concentration of consumers as these areas are not economical for privately owned electric utilities. They are incorporated under State law and are usually directed by an elected board of directors, which in turn selects a manager. Cooperatively owned electric utilities conduct their business much the same as other electric utilities. The Rural Electrification Administration, the National Rural Utilities Cooperative Finance Corporation, the Federal Financing Bank, and the Bank for Cooperatives are the most important sources of debt financing for cooperatives. There are approximately 960 cooperatively owned electric utilities currently doing business in 46 States.

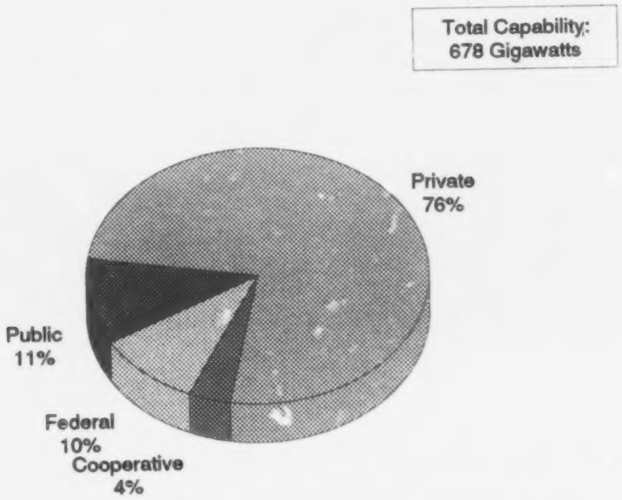
The following graphic presentation on the electric utility industry by class of ownership includes: generating capability; generation and sales of electricity; and, number of utilities, generators, and ultimate consumers. These data are collected and compiled from various sources as indicated in the Preface. The data on generating capability and generation of electricity are presented for all electric utilities that produce power in the United States. The data on electricity sales, revenue, and retail prices are also for all electric utilities in the United States; however, since a large number of electric utilities only transmit and distribute electricity, these statistics cover a larger number of utilities.

Figure 1. Generating Capability by Class of Ownership, 1988



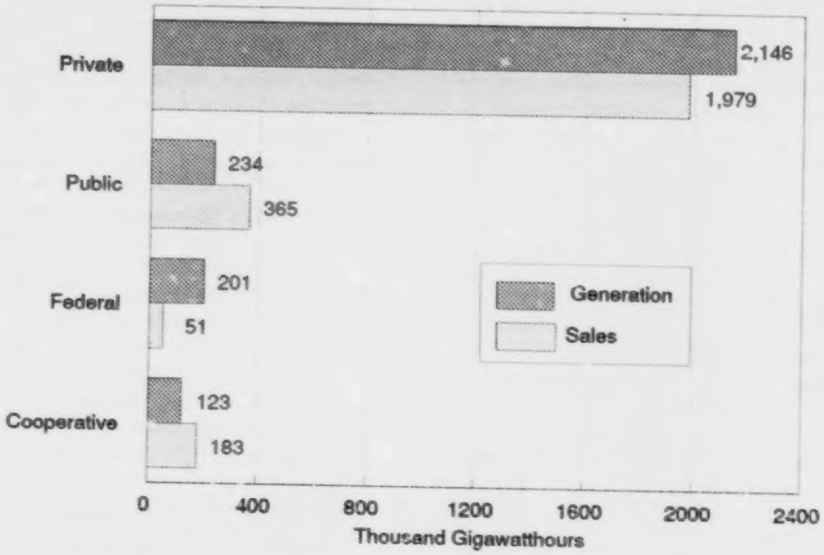
Notes: Generating capability is net summer capability. Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Figure 2. Share of Generating Capability by Class of Ownership, 1988



Notes: Generating capability is net summer capability. Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

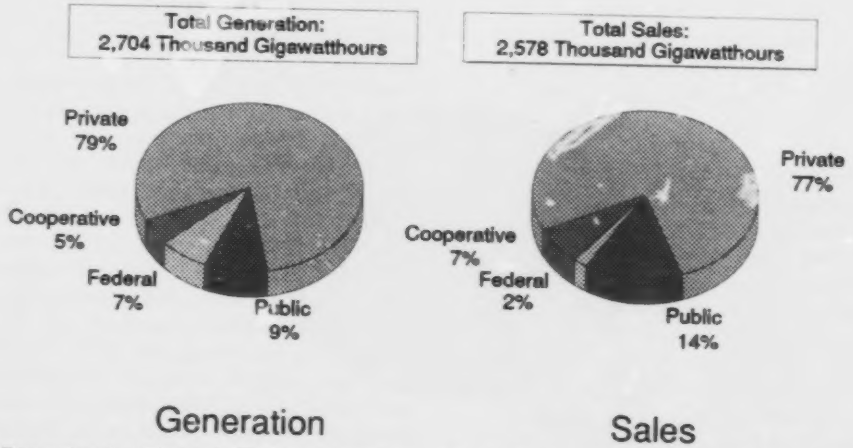
Figure 3. Generation and Sales of Electricity to Ultimate Consumers by Class of Ownership, 1988



Notes: Total nonutility generation of electricity, which is not included in the generation figure, was estimated to be 139 thousand gigawatthours in 1988. Nonutility sales of electricity to electric utilities (for resale to ultimate consumers) were 67 thousand gigawatthours and are included in the sales data in this graph.

Sources: **Utility generation:** Energy Information Administration, Form EIA-759, "Monthly Power Plant Report." **Nonutility generation:** *Annual Outlook for U.S. Electric Power 1989,* DOE/EIA-0474(89). **Sales:** Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

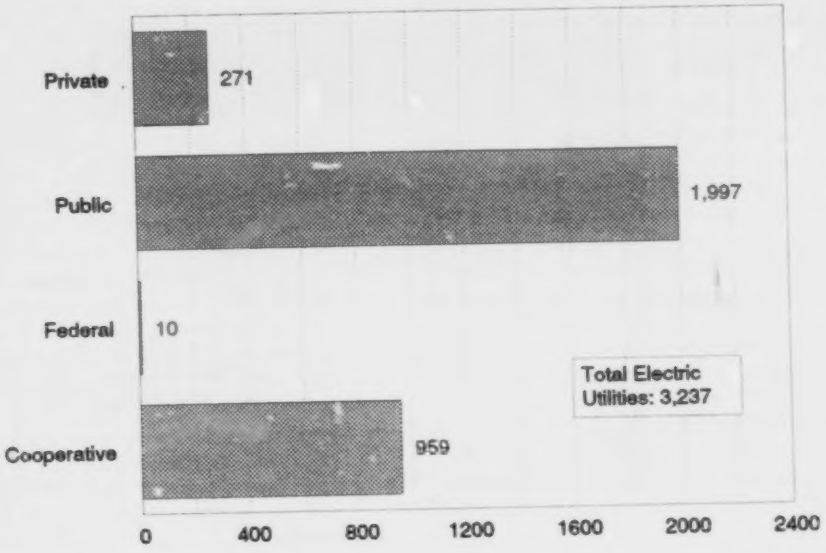
Figure 4. Share of Generation and Sales of Electricity to Ultimate Consumers by Class of Ownership, 1988



Notes: See notes for Figure 3. Totals may not equal sum of components because of independent rounding.

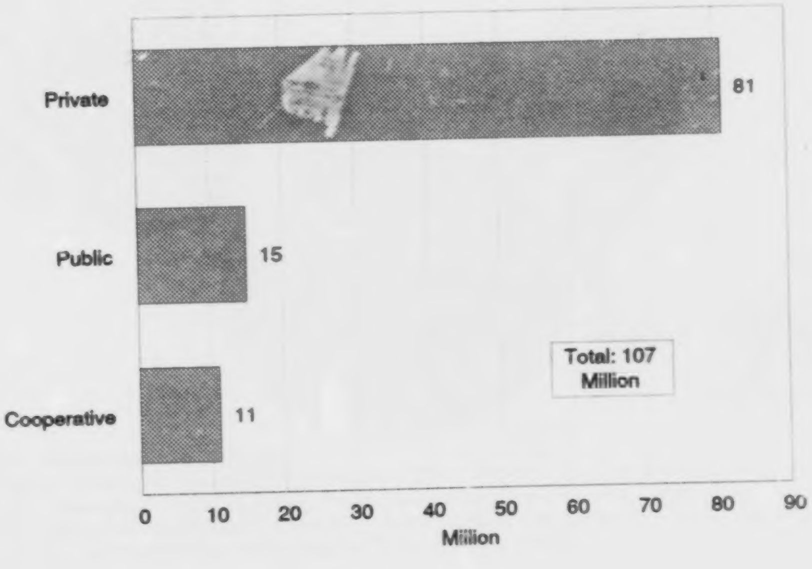
Sources: **Utility generation:** Energy Information Administration, Form EIA-759, "Monthly Power Plant Report." **Nonutility generation:** *Annual Outlook for U.S. Electric Power 1989,* DOE/EIA-0474(89). **Sales:** Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Figure 5. Number of Utilities by Class of Ownership, 1988



Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

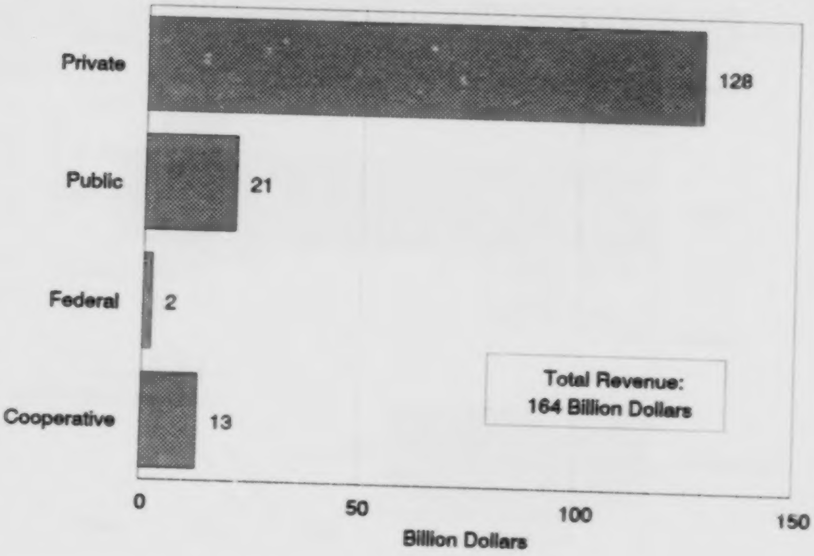
Figure 6. Number of Ultimate Consumers Served by Utility Class of Ownership, 1988



Notes: The number of ultimate consumers served by federally owned electric utilities is less than one million. The number of ultimate consumers is the average for the year. Totals may not equal sum of components because of independent rounding.

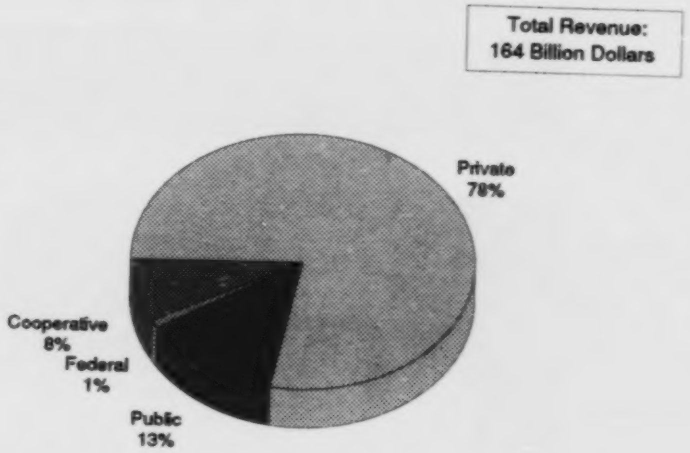
Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Figure 7. Revenue From Sales of Electricity to Ultimate Consumers by Class of Ownership, 1988



Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Figure 8. Share of Revenue From Sales of Electricity to Ultimate Consumers by Class of Ownership, 1988



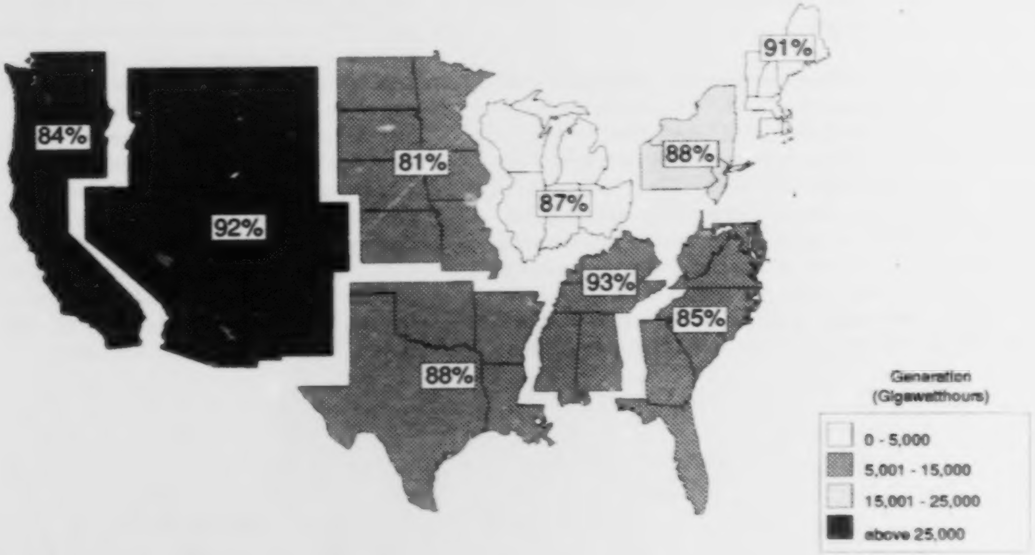
Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-861 "Annual Electric Utility Report."

A Review of the Year, 1988

Moderate economic growth (reflected by an increase in industrial production) and adverse weather conditions (cooler-than-normal temperatures during January, and warmer-than-normal temperatures during July and August) contributed to a greater demand for electricity in 1988 than in 1987. Record levels in the demand for electricity were set in August. A 6-percent increase in the total output of industrial goods in 1988 compared with 1987 that led to a 5-percent increase in the use of electricity by industry, also contributed to the overall increased demand for electricity (sales of electricity to the residential and commercial sectors also increased by 5 and 6 percent, respectively). Despite this increase in demand for electricity, generating capability increased less than 1 percent in 1988 --the smallest increase in 40 years. Electric generating capability totaled 678 gigawatts as of year-end 1988. Total generating capability (5,221 megawatts) in new units brought on line during 1988 was 52 percent less than comparable new generating capability brought on line in 1987. Electric utilities retired 1,668 megawatts of generating capability in 1988. The total number of electric utilities in 1988 was 3,237, down from 3,241 in 1987. The total number of electric utilities varies from year to year because of the formation of new electric utilities and mergers and acquisitions of existing electric utilities.

In response to the greater demand, total production of electricity in the United States increased by 5 percent, establishing a new record (Table 1), the highest growth since 1976 (when generation increased 6 percent from 1975). Generation of electricity in 1988 was 2,704 thousand gigawatthours. To meet the overall increase in demand for electricity, electric utilities increased production at coal-fired, nuclear-powered, and, to a lessor extent, petroleum-fired facilities. In some areas of the country, the increase in demand for electricity was compounded by the fact that hydroelectric generation was reduced severely because of drought.[1] For example, Idaho, which is 100 percent dependent on hydroelectricity, experienced a 17-percent reduction in its hydroelectric generation during 1988. Overall precipitation was below normal throughout the Nation (Figure 9).

Figure 9. Hydroelectric Net Generation and Percent of Normal Precipitation by Census Division, 1988



Note: Alaska and Hawaii are not included.

Sources: Generation: Energy Information Administration, Form EIA-759, "Annual Electric Generator Report." National Oceanic and Atmospheric Administration, **Precipitation for 1988:** *Monthly State, Regional and National Heating Degree Days Weighted by Population,* (March, 1989). **Normal Precipitation:** *State, Regional and National Monthly and Annual Precipitation Weighted by Area,* (August 1988).

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[1] For a more detailed discussion on the effects of the drought on the production and price of electricity, see the *Annual Outlook for U.S. Electric Power*, DOE/EIA-04[illegible](89), pages 6-9.

Total hydroelectric generation of electricity in the United States in 1988 was 223 thousand gigawatthours, an 11-percent reduction from 1987. Hydroelectric generation in 1988 declined to its lowest level in more than 10 years following 2 consecutive years of drought. The Idaho Power Company indicated that streamflow in 1988 on the Snake River, where most of its hydroelectric plants are located, was 19 percent below that in 1987 and 59 percent of normal. Normal, in this case, reflects an average of conditions for the years 1928 through 1987, as measured at the Brownlee Reservoir. Some utilities compensated for the loss in hydroelectric generation by increasing their fossil-fueled and nuclear-powered generation or by purchasing electricity from other utilities.

The need to compensate for the decrease in hydroelectric generation and meet the overall increase in demand was fulfilled by a 5-percent increase (77 thousand gigawatthours) in coal-fired generation in 1988 from 1987. Back-to-back records were set for coal-fired generation of electricity in 1988, in July and August. The addition of three new generating units with a combined net summer capability of 1,784 megawatts also contributed to the increase in generation from coal. These new coal-fired units were the Sam Seymour Unit 3 in Texas, operated by the Lower Colorado River Authority; the St. Johns River Power Plant Unit 2 in Florida, operated by the Jacksonville Electric Authority; and, the Scherer Unit 4 in Georgia, operated by the Georgia Power Company.

This increase in coal-fired generation was supported by a draw down of coal stocks. In 1987, as a precaution against a possible strike by the United Mine Workers (UMW), electric utilities increased their stockpiles of coal to an unusually high 171 million short tons. Many electric utilities drew their stocks down to more normal levels during 1988 to meet the increased generation. Consequently at the end of August 1988, coal stocks were 141 million short tons, the lowest level since July 1981 (when, following a strike by the UMW, coal stocks fell to 140 million short tons). In spite of this reduction of stockpiles, the need to produce electricity at coal-fired facilities precipitated purchases of coal in 1988 that established new records for receipts. Electric utilities received 728 million short tons of coal in 1988, while year-ending stocks of coal declined to 147 million short tons.[2]

Nuclear-powered generating units produced 527 thousand gigawatthours of electricity in 1988, an increase of 16 percent over the prior year. This established a new record for nuclear-powered generation of electricity. The nuclear share of total electricity generation increased from 17.7 percent in 1987 to 19.5 percent in 1988. In 1988, 13 percent (or 69 thousand gigawatts) of the total U. S. electricity produced with nuclear units occurred in Illinois, which has 13 nuclear units. The addition of two new nuclear-powered units during 1988 (the South Texas, Unit 1, Houston Lighting and Power Company and the Braidwood, Unit 2, Commonwealth Edison Company), as well as the operation of units at a higher capacity factor, contributed to the increased share of total generation by nuclear units. After 9 years with capacity factors averaging about 57 percent, the average capacity factor for nuclear units increased to 64 percent in 1988.

Petroleum-fired generating units produced 149 thousand gigawatthours of electricity in 1988, an increase of 26 percent. Factors that contributed to this increase include: gas utilities in California during the first quarter of 1988 curtailed their deliveries to electric utilities; regions where electric utilities consume petroleum for generation purposes had warmer-than-normal temperatures during the summer; and, the average cost of petroleum declined by 19 percent in 1988 from 1987. That decline in the average cost was accompanied by a 22-percent (42 million barrels) increase in receipts of petroleum at electric utilities during 1988 from 1987. During December, petroleum-fired generation was 18 billion kilowatthours, 64 percent higher than in December 1987. This was the highest monthly level since January 1982 when the level of petroleum-fired generation was 21 billion kilowatthours.

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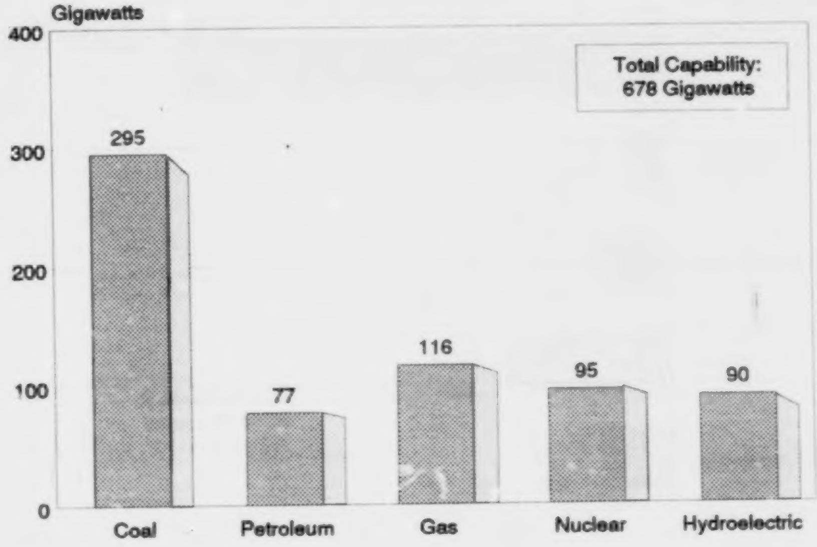
[2] Data for fossil fuel costs and receipts are collected on the FERC Form 423; data for fossil fuel stocks and consumption are collected on the Form EIA-759. Caution should be exercised when comparing data from these forms since the electric utilities surveyed by the FERC Form 423 represent approximately 86 percent of the total capacity of the electric utilities surveyed by the Form EIA-759. See Appendix D for a detailed description of these two forms.

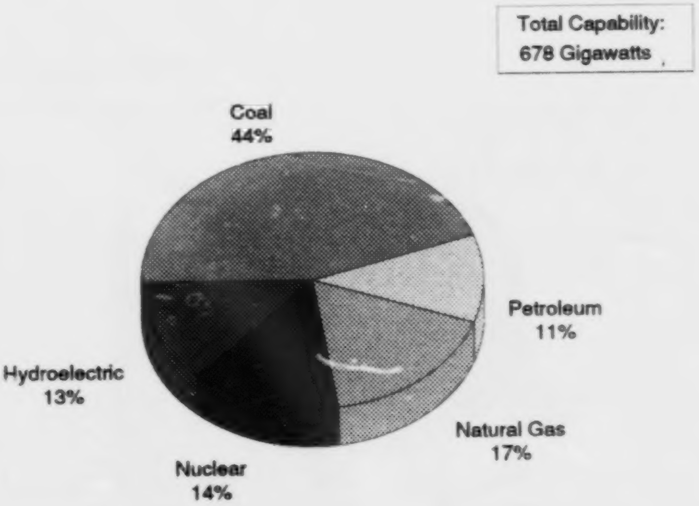
Figure 10. Generating Capability by Energy Source, 1988



Notes: Total value includes 4.5 gigawatts of other generating capability. Other includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

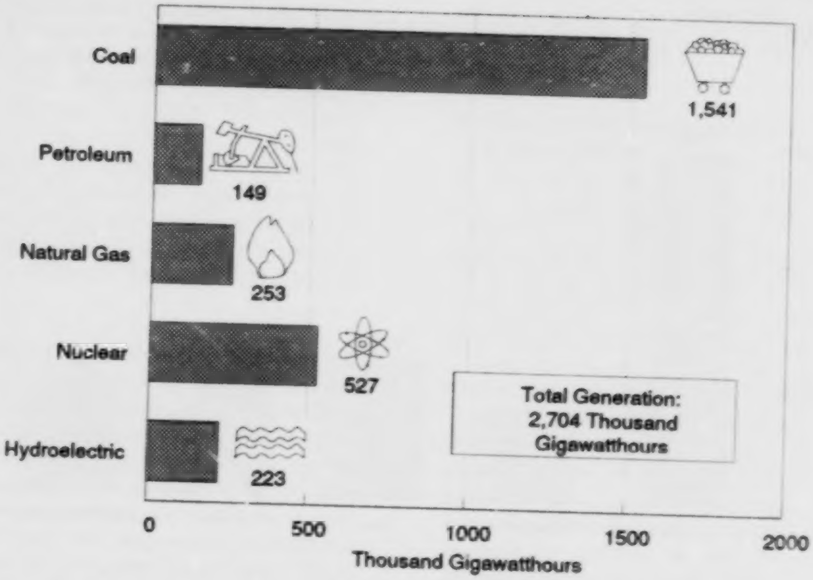
Figure 11. Share of Generating Capability by Energy Source, 1988



Notes: Total value includes 4.5 gigawatts of other generating capability. Other includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

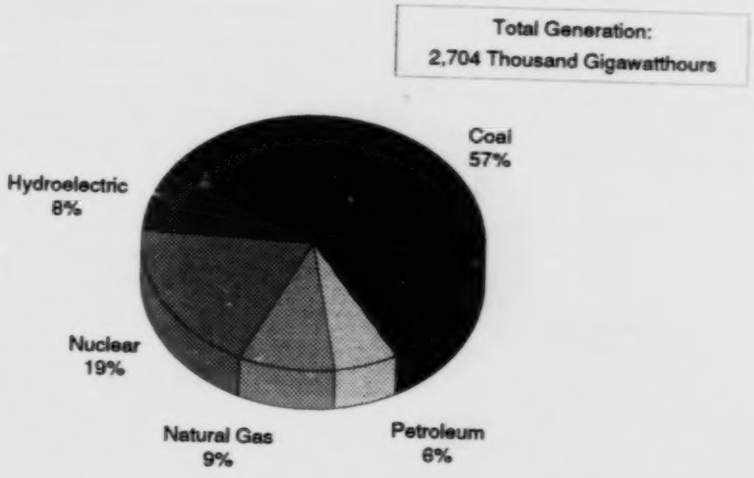
Figure 12. Generation by Energy Source, 1988



Note: Total generation value includes 12 thousand gigawatthours generation by other energy sources including geothermal, wood, wind, waste, and solar. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

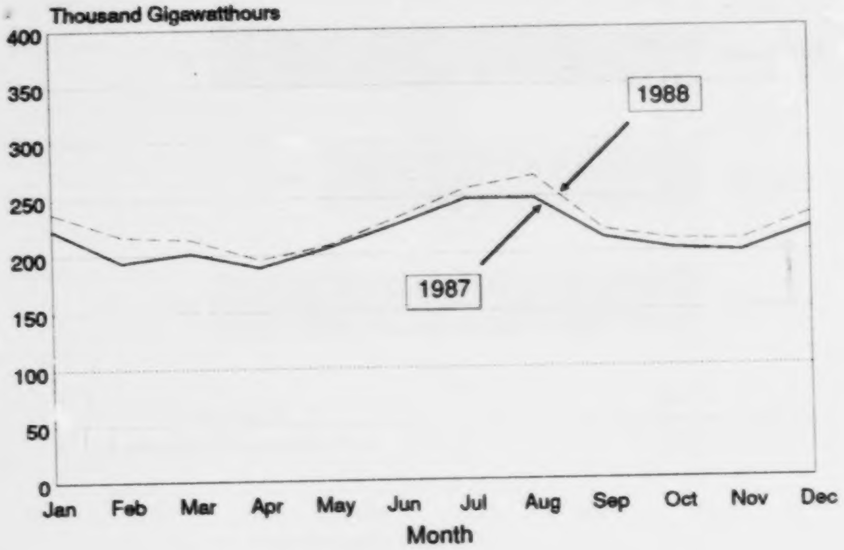
Figure 13. Share of Generation by Energy Source, 1988



Notes: Total value includes generation from other energy sources (geothermal, wood, wind, waste, and solar), which represents less than 1 percent of total generation. Totals may not equal sum of components because of independent rounding.

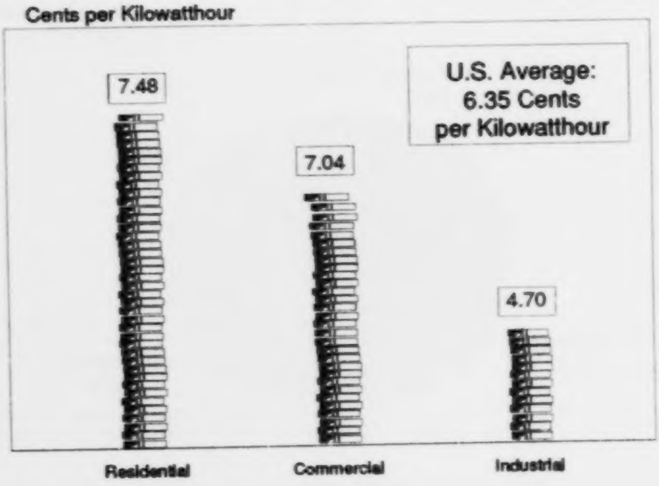
Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Figure 14. Monthly Generation, 1988 and 1987



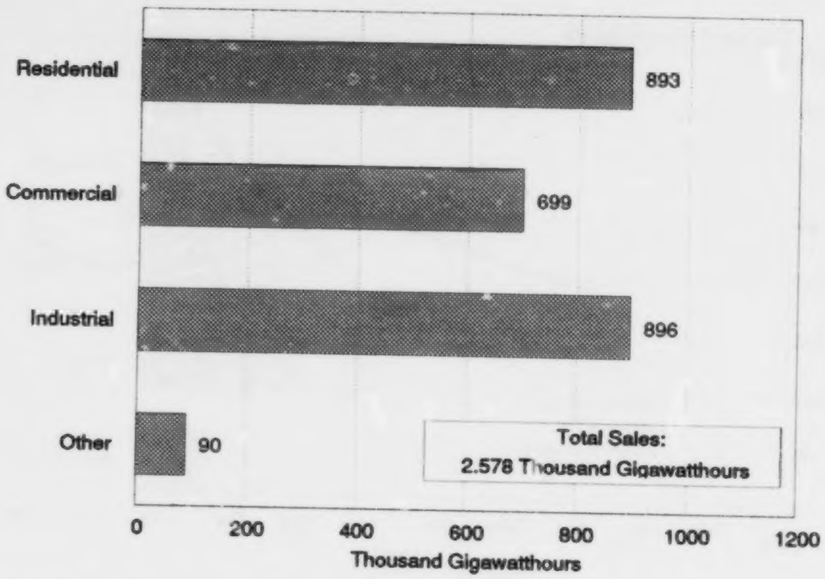
Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Figure 15. Average Price of Electricity per Kilowatthour by Sector, 1988



Source: Energy Information Administration, Form EIA-861,"Annual Electric Utility Report."

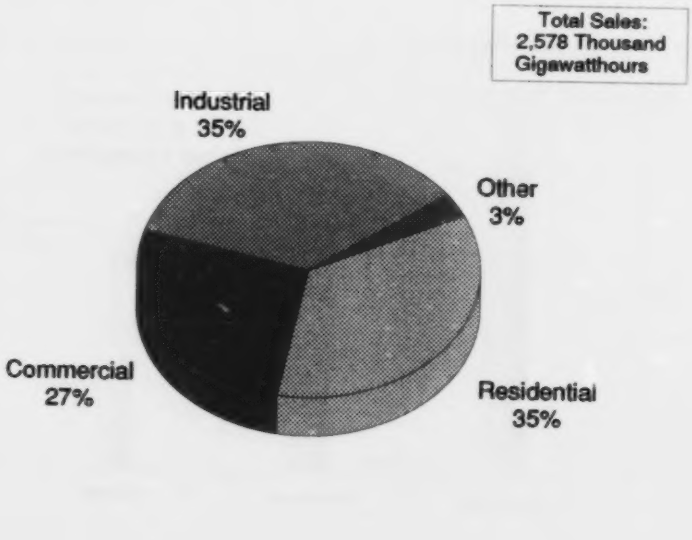
Figure 16. Sales of Electricity to Ultimate Consumers by Sector, 1988



Notes: Other includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Figure 17. Share of Sales of Electricity to Ultimate Consumers by Sector, 1988



Notes: Other includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 1. U.S. Summary Statistics, 1988 and 1987

Item	1988	1987	Percent Change from Previous Year
Generating Capability (megawatts)[1]	**677,654**	**674,144**	**0.5**
Steam	439,669	437,944	.4
Coal	R 294,685	292,595	.7
Petroleum	R 50,782	49,869	1.8
Gas	94,202	95,479	-1.3
Gas Turbine/Internal Combustion	48,536	48,982	-.9
Petroleum	26,352	26,267	.3
Gas	22,184	22,715	-2.3
Hydroelectric	90,284	89,665	.7
Nuclear	94,695	93,583	1.2
Other[2]	4,470	3,970	12.6
Generation (gigawatthours)	**2,704,250**	**2,572,127**	**5.1**
Coal	1,540,653	1,463,781	5.3
Petroleum	148,900	118,493	25.7
Gas	252,801	272,621	-7.3
Hydroelectric	222,940	249,695	-10.7
Nuclear	526,973	455,270	15.7
Other[3]	11,984	12,267	-2.3
Consumption			
Coal (1000 short tons)	758,372	717,894	5.6
Petroleum (1000 barrels)[4]	248,096	199,378	24.4
Gas (million cubic feet)	2,635,613	2,844,051	-7.3
Stocks			
Coal (1000 short tons)	146,507	170,797	-14.2
Petroleum (1000 barrels)[5]	69,285	70,827	-2.2
Receipts			
Coal (1000 short tons)	727,776	721,298	.9
Petroleum (1000 barrels)[6]	236,923	194,578	21.8
Gas (million cubic feet)[7]	2,362,721	2,605,191	-9.3
Cost (cents per million Btu)[8]			
Coal	146.6	150.6	-2.6
Petroleum[9]	243.9	301.1	-19.0
Gas	226.3	224.0	1.1
Sales (gigawatthours)	**2,578,062**	**2,457,272**	**4.9**
Residential	892,866	850,410	5.0
Commercial	699,100	660,433	5.9
Industrial	896,498	858,233	4.5
Other[10]	89,598	88,196	1.6
Revenue (thousand dollars)	**163,710,040**	**156,532,450**	**4.6**
Residential	66,790,048	63,317,819	5.5
Commercial	49,223,738	46,786,529	5.2
Industrial	42,145,316	40,949,358	2.9
Other[10]	5,550,938	5,478,744	1.3
Average Retail Electricity Prices (cents per kWh)	**6.35**	**6.37**	**-.3**
Residential	7.48	7.45	.4
Commercial	7.04	7.08	-.6
Industrial	4.70	4.77	-1.5
Other[10]	6.20	6.21	-.2

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[1] Net summer capability, based on primary energy source

[2] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.

[3] Includes geothermal, wood, wind, waste, and solar.

[4] Does not include petroleum coke. Petroleum coke consumption in 1988 was 409 thousand short tons and in 1987 was 348 thousand short tons.

[5] Does not include petroleum coke. Petroleum coke stocks at the end of 1988 were 86 thousand short tons and in 1987 were 51 thousand short tons.

[6] Does not include petroleum coke. Petroleum coke receipts in 1988 were 356 thousand short tons and in 1987 were 299 thousand short tons.

[7] Includes small amounts of coke-oven, refinery, and blast-furnace gas.

[8] Average cost of fuel delivered to plants with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts; average cost values are weighted.

[9] Does not include petroleum coke. Petroleum coke cost in 1988 was 97.2 cents per million Btu and in 1987 was 101.9 cents per million Btu.

[10] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

kWh = kilowatthours

R = Revised data.

Notes: •Totals may not equal sum of components because of independent rounding. •Percent change is calculated before rounding.

Sources: •Energy Information Administration, Form EIA-759, "Monthly Power Plant Report;" Form EIA-860, "Annual Electric Generator Report;" Form EIA-861, "Annual Electric Utility Report." •Federal Energy Regulatory Commission FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

Generating Capability

Since electricity is a clean and convenient source of energy, it is used for over one-third of the current energy supply in the United States and its share is expected to grow in the future. Consumers expect electricity to be instantly available, that is, at the flick of a switch. In fact, electricity is so important to the functioning of our society that its unavailability is newsworthy. Since the Northeast blackout of 1965, the electric power industry has organized to ensure that an adequate supply of electricity is available to meet all demand requirements at any given instant, both now and in the future. In order to meet these requirements, the electric power industry has built and maintained capacity to produce electricity for various types of demand and load requirements. This chapter provides an inventory of the capability of various methods for converting energy into electricity. Appendix B provides information regarding the plans the industry has for building additional capacity.

Background

Although energy cannot be created or destroyed (according to the laws of physics), it can be converted from one form into another form. Electricity is the result of a conversion process that is induced by rotating a magnet within a system of coiled wires, thus converting mechanical energy into electrical energy. The machine that performs this type of energy conversion is an electric generator. The device that causes the magnet to spin is a prime mover. A generating unit includes the electrical generator and all associated or physically connected equipment (such as a prime mover) that are operated together to produce electricity.

The generating units operated by an electric utility vary by intended usage, that is, by the type of load requirements the utility must meet. The load requirements placed on an electric utility are generally categorized as *baseload, intermediate load,* and *peak load.* A baseload generating unit is normally used to satisfy all or part of the minimum load of the system and, as a consequence, produces electricity at an essentially constant rate and runs continuously. These units are generally the newest, largest, and most efficient of the three types. (The *operating efficiency* of a generating unit is a function of the amount of net heat that it can extract from the energy source for use in the production of electricity.) A peak-load generating unit, which is normally the least efficient of the three types of units, is used to meet requirements during the periods of greatest load on the system. Intermediate-load generating units meet system requirements that are greater than baseload but less than peak load. These units are used during the transition between baseload and peak-load requirements. Utilities also have reserve or standby generating units, which are available to the system in the event of an unexpected increase in load or an unexpected outage within the system. Consequently, an inventory of net capability must account for reserve or standby capability, as well as generating units that are not available to the system for various reasons (such as routine maintenance).

Net capability in this report, unless otherwise stated, refers to that which is *operable,* or available to provide power to the system. An electric utility plant (station) contains generating units and auxiliary equipment that are used to convert various types of energy into electric energy. A fossil-fueled generating unit may be designed to use (burn) one or more fossil fuels to produce electricity. A generating unit capable of burning more than one fossil fuel is referred to as a dual-fired unit.[3] Some dual-fired units can only burn one fuel at a time (that is, the fuels are fired sequentially), while others can burn more than one fuel simultaneously (concurrent firing of different fuels). A sequentially fired unit generally uses one fossil fuel as its primary energy source but can switch to a second fossil fuel as an alternate energy source. Unless stated otherwise, information regarding generating capability in this report is based on the primary energy source.

Prime Movers

Electric utilities use a variety of prime movers based on the loads, availability of fuels, and energy requirements of the utility. The most common prime movers are the steam turbine, internal-combustion engine, gas combustion turbine, water turbine, and wind turbine. Most prime movers used to produce electricity today

[3] Energy Information Administration, *Fuel Choice in Steam Electric Generation: Historical Overview* (Washington, DC, August 1985) DOE/EIA-0472.

are turbines, (a series of blades mounted on a shaft against which fluids are forced thus rotating the shaft connected to the generator). A turbine converts the kinetic energy of the moving fluid (liquid or gas) to mechanical energy. The fluids most commonly used in turbines are steam, hot air or combustion products, and water. The nonrenewable energy sources most often used with today's prime movers are the fossil fuels -- coal, petroleum, and natural gas.

Steam Turbine Generating Units. Most of the electricity in the United States is produced in steam turbines. In a *fossil-fueled* steam turbine, the fuel is burned in a boiler to produce steam. The resulting steam then turns the turbine blades that turn the shaft of the generator to produce electricity. In a *nuclear-powered* steam turbine, the boiler is replaced by a reactor containing a core of nuclear fuel (primarily enriched uranium). Heat produced in the reactor by fission of the uranium is used to make steam. The steam is then passed through the turbine generator to produce electricity, as in the fossil-fueled steam turbine. Steam turbine generating units are used primarily to serve the base load of electric utilities. Fossil-fueled steam turbine generating units range in size (nameplate capacity) from 1 megawatt to over 1,000 megawatts. Nuclear-powered steam turbine generating units in operation today range in size from 75 megawatts to over 1,400 megawatts.

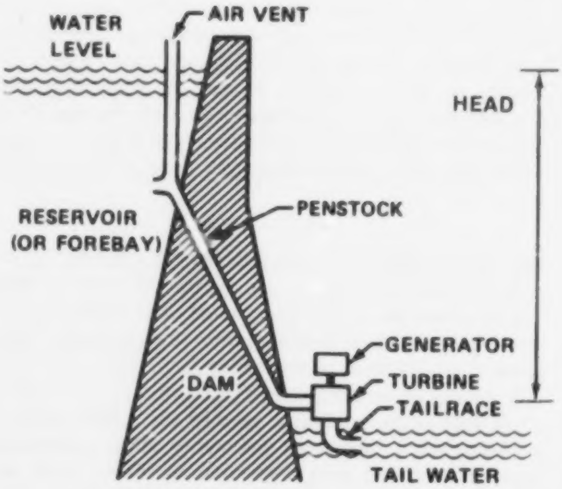
Gas Turbine Generating Units. In a gas turbine (combustion-turbine) unit, hot gases produced from the combustion of natural gas and distillate oil in a high-pressure combustion chamber are passed directly through the turbine, which spins the generator to produce electricity. Gas turbines are commonly used to serve the peak loads of the electric utility. Gas turbine units are generally less than 100 megawatts in size. Their wide choice of site locations and quick start-up time compared to steam-turbine generating units make them suitable for peaking, emergency, and reserve power.

The gas turbine, as is typical with peaking units, has a lower efficiency than the steam turbine used for baseload power. The efficiency of the gas turbine is increased when the gas turbine is coupled with a steam turbine in a *combined cycle* operation. In this system, the hot gases, which have already been used to spin one turbine generator are moved to a waste-heat recovery steam boiler where the water is heated to produce steam that in turn produces electricity by running a second steam-turbine generator. In this way, two generators produce electricity from one initial fuel input. All or part of the heat required to produce steam may come from the exhaust of the gas turbine. Thus the steam-turbine generator may be supplementarily fired in addition to the waste heat. Combined-cycle generating units generally serve intermediate loads.

Internal-Combustion Engines. These prime movers have one or more cylinders in which the combustion of fuel takes place. The engine, which is connected to the shaft of the generator, provides the mechanical energy to drive the generator to produce electricity. Internal-combustion (or diesel) generators can be easily transported, can be installed upon short notice, and can begin producing electricity nearly at the moment they start. Thus, like gas turbines they are usually operated during periods of high demand for electricity. They are generally about 5 megawatts in size.

Hydroelectric Generating Units. Hydroelectric power is the result of a process in which flowing water is used to spin a turbine connected to a generator. The two basic types of hydroelectric systems are those based on *falling water* and those based on *natural river current*. In the first system, water accumulates in reservoirs created by the use of dams. This water then falls through conduits (penstocks) and applies pressure against the turbine blades to drive the generator to produce electricity. In the second system, called a *run-of-the-river* system, the force of the river current (rather than falling water) applies pressure to the turbine blades to produce electricity. Since run-of-the-river systems do not usually have reservoirs and cannot store substantial quantities of water, power production from this type of system depends on seasonal changes and stream flow. These conventional hydroelectric generating units range in size from less than 1 megawatt to 700 megawatts. Because of their ability to start quickly and make rapid changes in power output, hydroelectric generating units are suitable for serving peak loads and providing spinning reserve power, as well as serving baseload requirements.

Figure 18. Hydroelectric Power System With Reservoir



Source: U.S. Department of Energy, *Energy Deskbook* (June 1982), p. 188.

Another kind of hydroelectric power generation is the *pumped storage* hydroelectric system. Pumped storage hydroelectric plants use the same principle for generation of power as the conventional hydroelectric operations based on falling water and river current. However, all or part of the water is made available for repeated use by pumping it from a lower to an upper reservoir. In the pumped storage operation, low-cost off-peak energy is used to pump water to an upper reservoir where it is stored as potential energy. The water is then released to flow back down through the turbine generator to produce electricity during periods of high electricity demand.

Other Generating Units. Other methods of electric power generation, which presently contribute only small amounts to total power production, have potential for expansion. These include *geothermal, refuse, waste heat, waste steam, solar, wind,* and *wood. Geothermal* power comes from heat energy buried deep beneath the surface of the earth. Although most of this heat is at depths beyond current drilling methods, in some areas of the country magma flows close enough to the surface of the earth to produce steam. That steam can then be harnessed for use in conventional steam-turbine plants. *Solar power* is derived from the energy (both light and heat) of the sun. *Photovoltaic conversion* generates electric power directly from the light of the sun; whereas, *solar-thermal* electric generators use the heat from the sun to produce steam to drive turbines. *Wind power* is derived from the conversion of the energy contained in wind into electricity. A wind turbine is similar to a typical wind mill. However, because of the intermittent nature of sunlight and wind, high capacity utilization factors cannot be achieved for these plants. Several electric utilities have incorporated *wood* and *refuse* (for example, municipal waste, corn cobs, and oats) as energy sources for producing electricity at their power plants. These sources replace fossil fuels in the boiler. The combustion of wood and refuse creates steam that is typically used in conventional steam-electric plants.

Generator Rating

The rating of a generator is a measure of its ability to produce electricity. Generators are rated by nameplate capacity. The *nameplate capacity* is the full-load continuous rating of the generator under specified conditions, as designated by the manufacturer, and is usually indicated on a metal plate attached physically to the generator. *Net capability* is the steady hourly output that the generating unit is expected to supply to the system load as demonstrated by test procedures. The capability of the generating unit in the summer is generally less than in the winter due to high ambient-air and cooling-water temperatures, which cause generating units to be less efficient. The measure used in this publication is net summer capability. The nameplate capacity of a generator is generally greater than its net capability. Nameplate capacity is a gross rating of the output of the generator whereas net capability is the output of the generating unit based on system load deducting the requirements of the plant.

Data Sources

The following tables contain a summary of the number of electric generators and electric generating capability at the national, regional, and State levels for the period 1986 through 1988. The number of generators are reported since this is a count of the physical equipment rather than generating units, which are a combination of one or more boilers, turbines, and generators operated together to produce electricity. The data in the tables were obtained from the Form EIA-860, "Annual Electric Generator Report." Data are reported annually on the Form EIA-860 by approximately 900 electric utilities in the United States that operate power plants or plan to operate power plants within 10 years of the reporting year. (See Appendix B for information regarding planned capability additions.) More detailed statistics from the Form EIA-860 are published in the *Inventory of Power Plants in the United States.*[4]

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[4] Energy Information Administration, *Inventory of Power Plants in the United States,* DOE/EIA-0095.

Table 2. Generating Capability by Prime Mover and Primary Energy Source, 1986-1988 (Megawatts)

Prime Mover/Primary Energy Source	1988	1987	1986
Fossil Steam	**439,669**	**437,944**	**438,100**
Coal-Fired	[R] 294,685	292,595	290,397
Petroleum-Fired	[R] 50,782	49,869	52,299
Gas-Fired	94,202	95,479	95,404
Gas Turbine/Internal Combustion	**48,536**	**48,982**	**47,970**
Petroleum-Fired	26,352	26,267	25,963
Gas-Fired	22,184	22,715	22,007
Hydroelectric	**90,284**	**89,665**	**89,331**
Nuclear	**94,695**	**93,583**	**85,304**
Other[1]	**4,470**	**3,970**	**4,102**
U.S. Total	**677,654**	**674,144**	**664,807**

[1] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.

R = Revised data.

Notes: •Totals may not equal sum of components because of independent rounding. •Generating capability is net summer capability. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 3. Summary of Capability Additions and Retirements, and Total Operable Capability by Energy Source, 1988

Primary Energy Source	Added		Retired		Operable	
	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)
Coal	3	1,784	8	343	[R] 1,268	[R] 294,685
Petroleum	25	73	51	197	[R] 3,353	[R] 77,134
Gas	13	637	16	262	1,966	116,386
Hydroelectric	33	218	10	16	3,496	90,284
Nuclear	2	2,341	[*] 1	[*] 840	108	94,695
Other[2]	3	168	3	11	114	4,470
U.S. Total	**79**	**5,221**	**89**	**1,668**	**10,305**	**677,654**

[1] Net summer capability.

[2] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.

[*] The Hanford-N Unit was placed in cold-standby status by the Department of Energy in February of 1988. It is projected to be retired in 1991, and is not expected to reenter service prior to its retirement.

R = Revised data.

Notes: •Totals may not equal sum of components because of independent rounding. •Total capability cannot be calculated from the prior year's capability by adjusting for retirements and newly added capability because capability ratings for independent generators change each year and generators are purchased from or sold to nonutilities. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 4. Generating Capability by Census Division and State, 1988 and 1987

Census Division State	1988		1987	
	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)
New England	**666**	**22,117**	**661**	**22,052**
Connecticut	89	7,128	87	7,060
Maine	184	2,360	183	2,363
Massachusetts	191	9,837	191	9,855
New Hampshire	51	1,431	51	1,414
Rhode Island	27	259	27	266
Vermont	124	1,102	122	1,094
Middle Atlantic	**981**	**76,937**	**982**	**76,571**
New Jersey	117	13,510	119	13,547
New York	620	31,040	621	30,661
Pennsylvania	244	32,387	242	32,363
East North Central	**1,712**	**110,761**	**1,720**	**110,399**
Illinois	338	32,576	354	31,984
Indiana	152	19,359	152	19,276
Michigan	582	22,409	571	22,447
Ohio	241	25,703	240	25,772
Wisconsin	399	10,713	403	10,919
West North Central	**1,918**	**53,596**	**1,950**	**53,439**
Iowa	407	7,756	425	7,833
Kansas	439	9,507	437	9,447
Minnesota	347	8,760	354	8,630
Missouri	331	14,999	333	14,930
Nebraska	261	5,421	267	5,449
North Dakota	50	4,525	51	4,516
South Dakota	83	2,628	83	2,634
South Atlantic	**1,317**	**126,212**	**1,327**	**125,212**
Delaware	26	1,765	27	1,766
District of Columbia	4	806	4	806
Florida	367	32,363	377	32,002
Georgia	196	19,507	195	18,757
Maryland	104	9,607	105	9,606
North Carolina	206	20,026	205	19,998
South Carolina	209	14,819	211	14,947
Virginia	146	12,820	144	12,842
West Virginia	59	14,499	59	14,488
East South Central	**469**	**57,777**	**471**	**57,818**
Alabama	145	18,789	145	18,778
Kentucky	109	15,043	111	15,111
Mississippi	50	6,949	50	6,925
Tennessee	165	16,996	165	17,003
West South Central	**814**	**98,367**	**820**	**96,060**
Arkansas	98	9,553	94	9,491
Louisiana	127	16,850	139	16,903
Oklahoma	158	12,758	157	12,713
Texas	431	59,206	430	56,953
Mountain	**825**	**49,120**	**825**	**49,011**
Arizona	120	14,448	119	14,498
Colorado	172	7,048	171	6,995
Idaho	116	2,244	114	2,220
Montana	102	4,951	103	4,976
Nevada	74	4,857	74	4,767
New Mexico	59	5,145	59	5,114
Utah	128	4,744	129	4,758
Wyoming	54	5,682	56	5,683
Pacific Contiguous	**1,131**	**79,811**	**1,130**	**80,653**
California	660	44,429	658	44,436
Oregon	189	11,236	189	11,235
Washington	282	24,146	283	24,982
Pacific Noncontiguous	**472**	**2,957**	**467**	**2,931**
Alaska	395	1,504	390	1,502
Hawaii	77	1,453	77	1,429
U.S. Total	**10,305**	**677,654**	**10,353**	**674,144**

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[1] Net summer capability.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 5. Coal-Fired, Nuclear, Hydroelectric, and Other Generating Capability by Census Division and State, 1988

Census Division State	Coal		Nuclear		Hydroelectric		Other[1]	
	Number of Generators	Capability[2] (megawatts)	Number of Generators	Capability[2] (megawatts)	Number of Generators	Capability[2] (megawatts)	Number of Generators	Capability[2] (megawatts)
New England	**15**	**2,747**	**6**	**5,391**	**371**	**3,027**	**6**	**287**
Connecticut	1	385	4	3,217	35	138	2	64
Maine	0	0	1	845	130	387	0	0
Massachusetts	9	1,746	2	834	66	1,778	3	176
New Hampshire	5	615	0	0	39	278	0	0
Rhode Island	0	0	0	0	1	1	0	0
Vermont	0	0	1	496	98	445	1	47
Middle Atlantic	**106**	**23,018**	**18**	**16,321**	**377**	**7,577**	**2**	**183**
New Jersey	9	1,652	4	3,863	3	330	1	114
New York	32	3,865	6	4,766	329	5,355	0	0
Pennsylvania	65	17,501	8	7,692	45	1,892	1	69
East North Central	**407**	**74,473**	**23**	**20,130**	**501**	**2,867**	**11**	**254**
Illinois	63	14,953	13	12,609	21	12	0	0
Indiana	80	18,291	0	0	20	76	0	0
Michigan	83	12,035	5	3,980	247	2,203	0	0
Ohio	123	21,910	2	2,041	7	120	4	154
Wisconsin	58	7,283	3	1,500	206	456	7	100
West North Central	**212**	**34,509**	**8**	**5,549**	**177**	**3,850**	**12**	**65**
Iowa	55	5,892	1	500	24	124	3	21
Kansas	20	5,010	1	1,128	7	2	2	*
Minnesota	56	5,724	3	1,549	64	145	7	44
Missouri	49	10,627	1	1,118	29	1,062	0	0
Nebraska	12	2,889	2	1,254	20	169	0	0
North Dakota	14	3,876	0	0	5	545	0	0
South Dakota	6	469	0	0	28	1,803	0	0
South Atlantic	**215**	**63,349**	**26**	**22,379**	**449**	**10,151**	**17**	**629**
Delaware	5	919	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0
Florida	R 29	R 9,833	5	3,676	7	46	7	482
Georgia	39	12,848	3	2,617	111	2,465	0	0
Maryland	14	3,972	2	1,650	13	428	1	1
North Carolina	47	12,430	5	4,698	105	1,867	3	78
South Carolina	24	4,818	7	6,346	121	2,136	3	69
Virginia	24	4,225	4	3,392	67	3,027	3	*
West Virginia	33	14,304	0	0	25	183	0	0
East South Central	**144**	**35,918**	**8**	**8,274**	**205**	**7,472**	**0**	**0**
Alabama	41	10,556	5	4,836	89	2,934	0	0
Kentucky	57	13,839	0	0	30	795	0	0
Mississippi	9	2,234	1	1,142	0	0	0	0
Tennessee	37	9,289	2	2,296	86	3,743	0	0
West South Central	**54**	**30,398**	**5**	**4,956**	**116**	**2,871**	**8**	**616**
Arkansas	5	3,817	2	1,694	38	1,250	0	0
Louisiana	6	3,333	2	2,011	0	0	1	203
Oklahoma	10	4,816	0	0	37	994	1	110
Texas	33	18,432	1	1,251	41	627	6	303
Mountain	**107**	**28,413**	**4**	**3,880**	**409**	**9,844**	**10**	**43**
Arizona	13	4,762	3	3,663	39	2,652	0	0
Colorado	31	4,965	1	217	48	1,055	0	0
Idaho	0	0	0	0	110	2,186	0	0
Montana	6	2,260	0	0	86	2,559	7	13
Nevada	8	2,692	0	0	18	944	0	0
New Mexico	13	3,894	0	0	6	56	0	0
Utah	17	4,430	0	0	77	141	1	5
Wyoming	19	5,410	0	0	25	251	1	4
Pacific Contiguous	**3**	**1,806**	**8**	**7,815**	**846**	**42,417**	**41**	**2,304**
California	0	0	6	5,611	410	12,469	38	2,098
Oregon	1	530	1	1,104	175	8,988	2	160
Washington	2	1,276	1	1,100	261	20,960	1	47
Pacific Noncontiguous	**5**	**56**	**0**	**0**	**45**	**207**	**7**	**88**
Alaska	5	56	0	0	41	203	5	81
Hawaii	0	0	0	0	4	3	2	6
U.S. Total	**R 1,268**	**R 294,685**	**108**	**94,695**	**3,496**	**90,284**	**114**	**4,470**

[1] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.
[2] Net summer capability.
* Value less than 0.5.
R = Revised data.

Notes: •Totals may not equal sum of components because of independent rounding. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 6. Petroleum-, Gas-, and Dual-Fired Steam Generating Capability by Census Division and State, 1988

Census Division State	Petroleum		Gas		Dual-Fired Petroleum/Gas		Total Petroleum and Gas	
	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)
New England	**53**	**6,957**	**0**	**0**	**23**	**2,085**	**76**	**9,081**
Connecticut	22	2,419	0	0	2	528	24	2,947
Maine	14	1,053	0	0	0	0	14	1,053
Massachusetts	15	3,078	0	0	15	1,327	30	4,406
New Hampshire	2	446	0	0	0	0	2	446
Rhode Island	0	0	0	0	6	229	6	229
Vermont	0	0	0	0	0	0	0	0
Middle Atlantic	**54**	**11,198**	**0**	**0**	**51**	**9,148**	**105**	**20,345**
New Jersey	16	1,609	0	0	16	1,906	32	3,515
New York	25	6,197	0	0	35	7,242	60	13,438
Pennsylvania	13	3,392	0	0	0	0	13	3,392
East North Central	**31**	**6,068**	**6**	**194**	**18**	**760**	**55**	**7,022**
Illinois	14	3,116	0	0	9	304	23	3,420
Indiana	5	193	2	120	0	0	7	313
Michigan	7	2,491	2	20	4	401	13	2,912
Ohio	5	268	0	0	1	17	6	285
Wisconsin	0	0	2	54	4	37	6	92
West North Central	**2**	**50**	**13**	**309**	**83**	**2,453**	**98**	**2,811**
Iowa	0	0	0	0	3	60	3	60
Kansas	0	0	2	60	56	1,899	58	1,959
Minnesota	2	50	1	2	5	56	8	108
Missouri	0	0	6	115	4	79	10	194
Nebraska	0	0	4	132	14	299	18	431
North Dakota	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	1	60	1	60
South Atlantic	**55**	**8,271**	**5**	**303**	**83**	**11,473**	**143**	**20,047**
Delaware	2	54	0	0	6	684	8	738
District of Columbia	2	550	0	0	0	0	2	550
Florida	R 31	R 5,508	5	303	61	8,009	R 97	R 13,820
Georgia	2	116	0	0	8	429	10	544
Maryland	13	1,022	0	0	4	1,439	17	2,461
North Carolina	0	0	0	0	0	0	0	0
South Carolina	2	92	0	0	3	94	5	186
Virginia	3	929	0	0	1	818	4	1,747
West Virginia	0	0	0	0	0	0	0	0
East South Central	**2**	**59**	**7**	**719**	**24**	**2,818**	**33**	**3,596**
Alabama	0	0	0	0	1	48	1	48
Kentucky	2	59	1	115	0	0	3	174
Mississippi	0	0	6	604	23	2,770	29	3,374
Tennessee	0	0	0	0	0	0	0	0
West South Central	**0**	**0**	**57**	**8,587**	**266**	**46,990**	**323**	**55,578**
Arkansas	0	0	0	0	15	2,480	15	2,480
Louisiana	0	0	14	551	63	10,533	77	11,084
Oklahoma	0	0	10	567	22	5,427	32	5,994
Texas	0	0	33	7,469	166	28,550	199	36,019
Mountain	**0**	**0**	**9**	**538**	**70**	**3,273**	**79**	**3,811**
Arizona	0	0	0	0	25	1,607	25	1,607
Colorado	0	0	1	8	15	263	16	271
Idaho	0	0	0	0	0	0	0	0
Montana	0	0	0	0	1	70	1	70
Nevada	0	0	1	113	8	618	9	731
New Mexico	0	0	7	417	20	649	27	1,066
Utah	0	0	0	0	1	66	1	66
Wyoming	0	0	0	0	0	0	0	0
Pacific Contiguous	**2**	**86**	**1**	**358**	**115**	**21,098**	**118**	**21,541**
California	0	0	1	358	115	21,098	116	21,456
Oregon	0	0	0	0	0	0	0	0
Washington	2	86	0	0	0	0	2	86
Pacific Noncontiguous	**25**	**1,151**	**0**	**0**	**0**	**0**	**25**	**1,151**
Alaska	0	0	0	0	0	0	0	0
Hawaii	25	1,151	0	0	0	0	25	1,151
U.S. Total	**R 224**	**R 33,880**	**98**	**11,008**	**733**	**100,096**	**R 1,055**	**R 144,984**

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[1] Net summer capability.

R = Revised data.

Notes: •Totals may not equal sum of components because of independent rounding. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 7. Petroleum-, Gas-, and Dual-Fired Gas Turbine/Internal Combustion Generating Capability by Census Division and State, 1988

Census Division State	Petroleum		Gas		Dual-Fired Petroleum/Gas		Total Petroleum and Gas	
	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)	Number of Generators	Capability[1] (megawatts)
New England	**173**	**1,193**	**0**	**0**	**17**	**391**	**190**	**1,584**
Connecticut	23	377	0	0	0	0	23	377
Maine	39	74	0	0	0	0	39	74
Massachusetts	63	526	0	0	16	371	79	897
New Hampshire	4	73	0	0	1	19	5	92
Rhode Island	20	28	0	0	0	0	20	28
Vermont	24	115	0	0	0	0	24	115
Middle Atlantic	**239**	**5,233**	**7**	**115**	**127**	**4,144**	**373**	**9,492**
New Jersey	28	1,798	3	51	37	2,187	68	4,036
New York	110	1,837	3	45	80	1,734	193	3,615
Pennsylvania	101	1,598	1	19	10	223	112	1,840
East North Central	**409**	**2,963**	**32**	**688**	**274**	**2,364**	**715**	**6,014**
Illinois	76	562	5	35	137	983	218	1,580
Indiana	26	286	8	246	11	147	45	679
Michigan	159	567	18	393	57	320	234	1,279
Ohio	61	778	1	14	37	402	99	1,194
Wisconsin	87	770	0	0	32	512	119	1,282
West North Central	**604**	**3,431**	**12**	**123**	**795**	**3,257**	**1,411**	**6,812**
Iowa	155	325	0	0	166	834	321	1,159
Kansas	51	290	3	18	297	1,099	351	1,407
Minnesota	119	821	1	1	89	368	209	1,190
Missouri	120	1,295	3	100	119	604	242	1,998
Nebraska	94	363	5	5	110	311	209	678
North Dakota	29	94	0	0	2	10	31	104
South Dakota	36	243	0	0	12	32	48	275
South Atlantic	**270**	**5,542**	**12**	**275**	**185**	**3,840**	**467**	**9,657**
Delaware	13	108	0	0	0	0	13	108
District of Columbia	2	256	0	0	0	0	2	256
Florida	123	2,735	0	0	99	1,772	222	4,507
Georgia	22	814	1	5	10	214	33	1,033
Maryland	41	696	9	246	7	153	57	1,095
North Carolina	28	478	0	0	18	476	46	953
South Carolina	9	197	1	9	39	1,058	49	1,264
Virginia	31	246	1	15	12	169	44	429
West Virginia	1	12	0	0	0	0	1	12
East South Central	**24**	**1,264**	**8**	**138**	**47**	**1,115**	**79**	**2,518**
Alabama	1	16	0	0	8	400	9	416
Kentucky	1	65	5	92	13	78	19	235
Mississippi	2	31	3	46	6	121	11	199
Tennessee	20	1,152	0	0	20	516	40	1,668
West South Central	**60**	**308**	**42**	**923**	**206**	**2,717**	**308**	**3,948**
Arkansas	16	202	0	0	22	110	38	312
Louisiana	12	44	0	0	29	175	41	219
Oklahoma	10	30	7	312	61	501	78	844
Texas	22	32	35	611	94	1,931	151	2,574
Mountain	**112**	**562**	**7**	**107**	**97**	**2,459**	**216**	**3,129**
Arizona	2	75	1	10	37	1,680	40	1,764
Colorado	44	336	0	0	32	204	76	540
Idaho	5	8	0	0	1	50	6	58
Montana	0	0	0	0	2	50	2	50
Nevada	31	78	1	12	7	401	39	490
New Mexico	8	25	3	83	1	16	12	123
Utah	13	24	2	3	17	59	32	85
Wyoming	9	18	0	0	0	0	9	18
Pacific Contiguous	**51**	**652**	**1**	**77**	**63**	**3,197**	**115**	**3,927**
California	41	559	1	77	48	2,160	90	2,795
Oregon	2	6	0	0	8	448	10	454
Washington	8	88	0	0	7	590	15	678
Pacific Noncontiguous	**368**	**755**	**7**	**281**	**15**	**419**	**390**	**1,455**
Alaska	322	464	7	281	15	419	344	1,164
Hawaii	46	292	0	0	0	0	46	292
U.S. Total	**2,310**	**21,905**	**128**	**2,727**	**1,826**	**23,904**	**4,264**	**48,536**

[1] Net summer capability.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Net Generation

This chapter provides summary statistics on the amount of electricity produced in the United States. The different energy sources used to produce electric power are discussed in this chapter.

Background

The production of electricity is generally referred to as generation, and is measured in kilowatthours. Gross generation is the amount of power produced by an electric power plant (station), measured at the plant's terminals (that is, prior to the point at which the power leaves the station and is available to the system). Some of the electric power generated at a power plant is used to operate equipment at the plant. Power used at the plant is generally between 1 percent (hydroelectric units) and 7 percent (steam-electric units). Net generation is the power available to the system (gross generation less use at the plant); however, it is greater than that available to consumers due to losses during transmission and distribution. Net generation is the measure of electric power production used in this report.

The energy sources used for producing electricity fall into two broad categories: nonrenewable (those that cannot be replaced once used) and renewable (those that are constantly replenished). The most common nonrenewable energy sources used for generation are the fossil fuels (coal, petroleum, and natural gas) and uranium. These energy sources account for more than 85 percent of the Nation's net generation. The renewable energy sources include the light or heat of the sun (solar); wind; the water in rivers, streams, or lakes (hydroelectric); heat from beneath the earth's surface (geothermal); and, organic wastes, which are produced by either natural or technological processes.

The choice of generating technology and fuel used to produce electricity is of major importance to electric utilities because the goal is to provide the least-cost and most reliable electricity possible to consumers. A variety of factors influence the selection of technology and fuel including the capital costs of the technology, operations and maintenance costs, environmental restrictions on the technology and use of the fuel, regulations affecting fuel use, the cost and availability of the fuel, and the availability of capacity associated with the type of fuel. The previous chapter covers the type and amount of U.S. generating capability and the following chapter covers the costs of fossil fuels.

Generation from Fossil Fuels

Coal. Historically, most of the generation in the United States has been from coal. After the Arab oil embargo of 1973, concerns over the availability of petroleum imports, increasing petroleum prices, and curtailments of natural gas made coal-fired generation even more important. In 1978, the passage of the Powerplant and Industrial Fuel Use and Natural Gas Policy Acts encouraged further use of coal by electric utilities. Although both Federal and State environmental laws and regulations exist, during the 1970's, renewed interest in environmental issues raised concerns about electric power plant emissions, particularly from those burning coal. Bills have been introduced during the 101st Congress to control acid rain or related air quality problems (see the Environmental Statistics Chapter). Coal-fired generation continues to provide more than one-half of the Nation's total net generation of electricity. Most of the electricity production from coal is in the East North Central and South Atlantic Census Divisions where substantial amounts of coal are mined.

Petroleum. During the early 1970's, electric utilities used petroleum extensively to generate electricity because it was a relatively inexpensive fuel. But after the 1973 embargo by the Organization of Petroleum Exporting Countries (OPEC) on petroleum exports to the United States, petroleum prices rose sharply. Further price increases occurred in 1979 and 1980 following the Iranian revolution and subsequent reductions in Iranian petroleum exports. Consequently during the past decade, utilities have not built large, petroleum-fired steam units. In addition, many utilities have either converted steam units to coal or switched fuels where dual-fired capability exists. Most of the utilities that still rely heavily on petroleum to generate electricity are located along the eastern seaboard and in California. Because of recent declines in petroleum prices, use of petroleum-fired capability has shown a resurgence.

Natural Gas. The demand for natural gas to heat homes and serve business and industry has historically taken priority over the demand of electric utilities under both Federal and State regulations. In the 1970's, many utilities were on occasion denied natural gas when available pipelines reached capacity in serving heating demand during the months from November to March (the peak heating season). By the middle 1970's, curtailments to electric utilities also occasionally occurred during the nonheating season as producers conserved supply in preparation for heating season demand. In the face of an attractive interstate price structure but deprived of supplies during many months of the year, utilities in the 1970's used relatively less-expensive natural gas when it was available, then switched to other more expensive fuels when gas supplies were curtailed. Natural gas became more available to utilities with the passage of the Natural Gas Policy Act of 1978 and more frequent exemptions from the gas-use restrictions of the Powerplant and Industrial Fuel Use Act (Fuel Use Act) of 1978. Although lower petroleum prices during recent years have resulted in a decline in gas-fired generation, amendments to the Fuel Use Act in 1987, have created potential for additional future use of natural gas. The amendments to the Fuel Use Act in 1987 eased restrictions on the use of gas by removing a legal requirement to obtain an exemption for the construction of new gas-fired generating capability. The West South Central Census Division supplies more than half of the gas-fired generation in the country where most of the gas production in the Nation occurs.

Generation from Uranium

Generation from nuclear power has generally increased since the 1950's, and this trend continues. Since 1984, nuclear plants have provided the second largest share of total U.S. generation of electricity, after coal-fired plants. Although no new nuclear units have been ordered since 1978, and the units ordered after 1974 were not built, many that were under construction have either been completed and entered service or will enter service in the near future. Licensing delays, questions about radioactive waste disposal, and concern about nuclear plant safety have slowed these units from entering service and are still major obstacles to additional growth in the use of this energy source for generating electricity. Most of the nuclear-powered generation comes from the Middle Atlantic, East North Central, and South Atlantic Census Divisions where over 60 percent of the nuclear units in the country are located.

Generation from Renewable Fuels

Hydroelectric. Water is currently the leading renewable energy source used to generate electric power. However, hydroelectric plants can operate only where suitable waterways are available, and many of the best of these sites have already been developed. Generating electricity using water has several advantages. The major advantage is that water is a resource, which is renewable. A pumped-storage hydroelectric plant offers a second advantage in that these systems use electricity produced by other generators (generally those that serve baseload requirements) to pump water from one storage area (reservoir) to another. Later this water is allowed to flow from the higher reservoir to the lower one through the generator. In this manner, the same energy source (water) is used twice. Net hydroelectric generation statistics reflected in this report are derived by deducting the generation used for pumping (in house use) from the total (gross) hydroelectric generation. Since water is renewable, it is a source of cheap power. In addition, because there is no fuel combustion, there is little air pollution in comparison with fossil fuel plants and limited thermal pollution in comparison with nuclear plants. Like other energy sources, the use of water for generation has limitations, including environmental impacts caused by damming rivers and streams, which affects the habitats of the local plant, fish, and animal life. Nearly 70 percent of the hydroelectric power in the United States is generated in the Pacific and Rocky Mountain States.

Other Sources. Other renewable resources -- geothermal (heat energy buried deep beneath the surface of the earth), wood, waste, wind, and the sun (solar) -- are energy sources that are constantly replenished. These energy sources have received increased attention in recent years from utilities, but a limited number of such generating facilities are in use today. The major obstacles to their use are technology and cost. Currently, renewable resources (other than water) supply less than 1 percent of the Nation's electricity. Most of the electricity produced from this category is from geothermal power. Currently electric utilities operate geothermal plants in three States (California, Hawaii, and Utah). The Geysers, operated by the Pacific Gas and Electric Company, is the largest geothermal plant in the Nation. Only a few utilities operate units that produce electricity from wind and solar energy. Most of the electricity from these energy sources is produced from facilities in California. Wood and waste resources can be used to replace fossil fuels in utility boilers. To date, just a few electric generating units have been built that use wood as a primary fuel.

Data Sources

The data in the following tables are aggregated at the national, regional, and State levels for the period 1984 through 1988. The data in the tables were obtained from the Form EIA-759, "Monthly Power Plant Report." The Form EIA-759 is used to collect monthly data from all operators of electric utilities (approximately 800) in the United States. More detailed statistics from the Form EIA-759 are published in the *Electric Power Monthly*.[5]

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[5] Energy Information Administration, *Electric Power Monthly* DOE/EIA-0226 (Washington, DC).

The Geysers Geothermal Powerplant is owned by the Pacific Gas and Electric Company. This plant, located in California, is the largest geothermal facility in the world.

Table 8. Net Generation by Energy Source, 1984-1988
(Gigawatthours)

Energy Source	1988	1987	1986	1985	1984
Coal	1,540,653	1,463,781	1,385,831	1,402,128	1,341,681
Petroleum	148,900	118,493	136,585	100,202	119,808
Steam[1]	143,801	114,949	133,210	97,490	116,765
Gas Turbine/Internal Combustion	5,099	3,543	3,375	2,712	3,042
Gas	252,801	272,621	248,508	291,946	297,394
Steam	236,280	257,982	236,484	278,812	283,736
Gas Turbine/Internal Combustion	16,521	14,639	12,024	13,134	13,658
Hydroelectric	222,940	249,695	290,844	281,149	321,150
Nuclear	526,973	455,270	414,038	383,691	327,634
Other[2]	11,984	12,267	11,503	10,724	8,638
U.S. Total	2,704,250	2,572,127	2,487,310	2,469,841	2,416,304

[1] Includes petroleum coke.

[2] Includes geothermal, wood, wind, waste, and solar.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 9. Net Generation by Selected Prime Mover, Census Division, and State, 1988 and 1987

(Gigawatthours)

Census Division State	Total U.S.		Steam[1]		Gas Turbine/Internal Combustion	
	1988	1987	1988	1987	1988	1987
New England	**93,383**	**87,769**	**55,332**	**53,014**	**1,391**	**1,235**
Connecticut	36,379	33,173	13,483	12,255	78	40
Maine	9,530	8,346	2,928	2,593	16	7
Massachusetts	34,664	34,735	32,173	32,201	1,225	1,150
New Hampshire	6,997	6,045	6,006	5,141	24	7
Rhode Island	764	837	742	823	22	14
Vermont	5,049	4,634	0	0	26	17
Middle Atlantic	**317,806**	**302,317**	**203,996**	**190,349**	**3,498**	**2,998**
New Jersey	40,160	39,324	14,753	15,112	1,738	1,827
New York	124,714	117,630	75,333	66,325	1,304	832
Pennsylvania	152,932	145,363	113,910	108,911	456	338
East North Central	**465,198**	**439,189**	**354,938**	**352,501**	**464**	**270**
Illinois	123,340	109,887	54,014	59,522	112	81
Indiana	83,954	78,575	83,482	78,048	30	20
Michigan	88,868	87,035	70,428	72,190	149	91
Ohio	124,034	119,661	114,977	111,540	65	31
Wisconsin	45,003	44,030	32,037	31,201	107	46
West North Central	**214,979**	**195,238**	**165,047**	**147,221**	**617**	**439**
Iowa	27,729	25,549	23,721	21,937	91	52
Kansas	31,385	30,822	24,373	24,070	351	272
Minnesota	40,252	34,406	27,242	22,062	37	29
Missouri	59,740	55,387	49,198	47,292	96	64
Nebraska	20,635	20,489	12,420	10,312	37	21
North Dakota	27,351	22,620	25,468	20,637	*	*
South Dakota	7,886	6,265	2,626	909	5	2
South Atlantic	**526,309**	**505,870**	**373,668**	**361,063**	**1,425**	**1,289**
Delaware	8,953	8,511	8,930	8,489	23	21
District of Columbia	469	233	419	213	50	21
Florida	124,053	110,765	96,972	91,024	674	752
Georgia	82,375	85,806	65,149	67,421	65	5
Maryland	40,384	36,251	26,908	24,166	357	352
North Carolina	78,406	78,825	46,264	45,036	106	91
South Carolina	65,183	64,410	23,743	22,952	64	8
Virginia	45,172	42,697	24,266	23,706	86	39
West Virginia	81,314	78,372	81,016	78,057	*	*
East South Central	**228,905**	**217,490**	**189,591**	**180,388**	**437**	**283**
Alabama	67,518	69,336	49,100	50,628	78	11
Kentucky	76,436	67,454	74,008	64,505	5	1
Mississippi	25,093	22,388	15,256	14,419	254	252
Tennessee	59,858	58,312	51,226	50,836	100	18
West South Central	**355,752**	**342,952**	**316,908**	**306,414**	**6,307**	**5,098**
Arkansas	33,764	36,287	22,059	22,510	24	1
Louisiana	56,774	51,309	42,294	38,982	694	3
Oklahoma	44,035	42,737	40,000	37,312	1,990	2,477
Texas	221,180	212,620	212,555	207,610	3,598	2,618
Mountain	**239,474**	**216,143**	**186,184**	**168,009**	**1,386**	**1,007**
Arizona	61,562	51,600	29,679	27,121	1,171	901
Colorado	30,895	28,810	28,463	26,808	26	8
Idaho	6,746	8,105	NA	NA	*	*
Montana	24,821	20,884	16,526	11,910	3	1
Nevada	20,296	17,442	18,091	14,862	114	54
New Mexico	26,369	25,585	26,200	25,387	69	34
Utah	29,637	26,346	28,866	25,318	4	8
Wyoming	39,147	37,370	38,359	36,603	*	*
Pacific Contiguous	**250,622**	**253,839**	**67,355**	**70,579**	**2,953**	**2,319**
California	125,981	130,344	58,708	62,440	2,806	2,315
Oregon	41,048	39,739	-31	-33	-6	-6
Washington	83,593	83,756	8,678	8,172	153	10
Pacific Noncontiguous	**11,822**	**11,319**	**7,715**	**7,175**	**3,142**	**3,244**
Alaska	4,195	4,122	728	545	2,531	2,706
Hawaii	7,627	7,197	6,987	6,630	610	538
U.S. Total	**2,704,250**	**2,572,127**	**1,920,734**	**1,836,713**	**21,620**	**18,182**

[1] Sum of coal-, petroleum-, and gas-fired steam.

* Value less than 0.5 gigawatthours.

NA = Not applicable.

Notes: •Negative generation denotes that electric power consumed for plant use exceeds gross generation. •Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 10. Net Generation by Energy Source, Census Division, and State, 1988 and 1987
(Gigawatthours)

Census Division State	Coal		Petroleum		Gas	
	1988	1987	1988	1987	1988	1987
New England	**16,979**	**16,674**	**37,811**	**32,831**	**1,933**	**4,744**
Connecticut	2,094	1,940	11,356	9,648	111	707
Maine	NA	NA	2,944	2,600	NA	NA
Massachusetts	11,687	11,681	19,908	18,069	1,802	3,602
New Hampshire	3,197	3,053	2,328	2,094	5	1
Rhode Island	0	0	749	402	15	434
Vermont	NA	0	26	17	NA	0
Middle Atlantic	**136,163**	**128,211**	**52,832**	**42,202**	**18,499**	**22,933**
New Jersey	7,163	7,425	5,052	3,131	4,276	6,384
New York	22,761	19,384	39,865	31,389	14,012	16,385
Pennsylvania	106,239	101,403	7,915	7,683	211	164
East North Central	**350,816**	**348,954**	**3,006**	**2,877**	**1,580**	**940**
Illinois	52,994	57,933	697	1,465	435	205
Indiana	82,813	77,620	383	342	317	107
Michigan	68,578	71,135	1,414	718	585	428
Ohio	114,564	111,233	415	278	63	60
Wisconsin	31,867	31,032	97	74	180	140
West North Central	**162,491**	**145,252**	**571**	**314**	**2,602**	**2,094**
Iowa	23,345	21,704	49	48	417	238
Kansas	23,089	23,075	147	73	1,489	1,194
Minnesota	26,726	21,627	142	37	410	427
Missouri	49,051	47,170	131	86	112	100
Nebraska	12,225	10,153	69	47	163	133
North Dakota	25,450	20,618	18	19	*	*
South Dakota	2,605	905	15	3	11	3
South Atlantic	**323,188**	**314,800**	**35,930**	**28,991**	**15,975**	**18,561**
Delaware	5,788	5,881	2,848	1,837	317	792
District of Columbia	NA	NA	469	233	NA	NA
Florida	57,516	54,640	25,387	20,628	14,744	16,507
Georgia	64,834	67,185	260	184	119	57
Maryland	23,316	21,003	3,547	2,591	402	924
North Carolina	46,090	44,836	225	225	55	66
South Carolina	23,485	22,861	96	70	226	30
Virginia	21,413	20,621	2,838	2,961	102	163
West Virginia	80,747	77,773	260	262	10	22
East South Central	**185,856**	**176,677**	**1,079**	**356**	**3,092**	**3,638**
Alabama	48,835	50,501	107	31	236	108
Kentucky	73,847	64,352	126	121	40	32
Mississippi	12,051	11,094	659	80	2,800	3,497
Tennessee	51,122	50,730	187	124	16	*
West South Central	**175,455**	**161,969**	**1,200**	**646**	**146,560**	**148,897**
Arkansas	19,876	19,373	143	5	2,065	3,132
Louisiana	18,431	15,102	272	60	24,286	23,823
Oklahoma	24,273	21,089	29	30	17,688	18,670
Texas	112,876	106,405	756	551	102,521	103,272
Mountain	**180,748**	**162,834**	**896**	**698**	**5,927**	**5,484**
Arizona	28,391	25,344	119	226	2,341	2,452
Colorado	27,801	26,192	39	19	649	605
Idaho	NA	NA	*	*	0	*
Montana	16,462	11,836	30	17	37	58
Nevada	16,764	14,076	542	249	809	591
New Mexico	24,245	23,628	45	36	1,979	1,756
Utah	28,806	25,221	59	92	5	13
Wyoming	38,279	36,535	62	59	18	9
Pacific Contiguous	**8,641**	**8,133**	**7,622**	**2,097**	**54,045**	**62,668**
California	NA	NA	7,621	2,095	53,893	62,660
Oregon	-30	-33	-7	-6	0	0
Washington	8,670	8,166	8	8	153	7
Pacific Noncontiguous	**316**	**277**	**7,953**	**7,480**	**2,588**	**2,662**
Alaska	316	277	356	312	2,588	2,662
Hawaii	NA	NA	7,597	7,169	0	*
U.S. Total	**1,540,653**	**1,463,781**	**148,900**	**118,493**	**252,801**	**272,621**

* Value less than 0.5 gigawatthours.

NA = Not applicable.

Notes: •Negative generation denotes that electric power consumed for plant use exceeds gross generation. •Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 10. Net Generation by Energy Source, Census Division, and State, 1988 and 1987 (Continued)

(Gigawatthours)

Census Division State	Nuclear		Hydroelectric[1]		Other[2]	
	1988	1987	1988	1987	1988	1987
New England	**32,499**	**29,256**	**3,819**	**4,109**	**342**	**156**
Connecticut	22,251	20,540	324	337	242	NA
Maine	5,017	4,043	1,569	1,703	NA	NA
Massachusetts	1,117	1,136	150	247	NA	NA
New Hampshire	NA	NA	968	896	NA	NA
Rhode Island	NA	NA	0	0	NA	NA
Vermont	4,114	3,536	809	925	100	156
Middle Atlantic	**85,928**	**80,606**	**24,384**	**28,365**	**0**	*
New Jersey	23,890	22,697	-222	-312	NA	NA
New York	24,175	22,926	23,901	27,546	0	*
Pennsylvania	37,862	34,982	705	1,131	NA	NA
East North Central	**106,893**	**83,407**	**2,389**	**2,505**	**514**	**506**
Illinois	69,166	50,194	48	90	NA	NA
Indiana	NA	NA	441	507	NA	NA
Michigan	17,808	14,389	483	364	0	0
Ohio	8,455	7,513	187	225	351	352
Wisconsin	11,464	11,311	1,230	1,319	164	154
West North Central	**37,865**	**35,421**	**11,240**	**12,050**	**210**	**108**
Iowa	3,163	2,523	698	970	57	67
Kansas	6,650	6,471	12	9	*	*
Minnesota	12,288	11,554	532	720	153	41
Missouri	8,935	6,284	1,511	1,447	NA	NA
Nebraska	6,828	8,589	1,350	1,567	NA	NA
North Dakota	NA	NA	1,884	1,982	0	*
South Dakota	NA	NA	5,254	5,354	NA	NA
South Atlantic	**144,010**	**130,137**	**7,149**	**13,330**	**57**	**51**
Delaware	NA	NA	NA	0	NA	NA
District of Columbia	NA	NA	NA	0	NA	NA
Florida	26,198	18,773	209	217	0	0
Georgia	15,149	15,259	2,011	3,121	NA	NA
Maryland	11,734	10,070	1,328	1,612	57	51
North Carolina	29,146	28,600	2,890	5,098	NA	NA
South Carolina	40,746	39,290	631	2,160	NA	NA
Virginia	21,037	18,145	-218	807	*	NA
West Virginia	NA	NA	297	315	NA	NA
East South Central	**26,504**	**18,857**	**12,374**	**17,962**	**NA**	**NA**
Alabama	12,981	11,248	5,359	7,449	NA	NA
Kentucky	NA	NA	2,423	2,948	NA	NA
Mississippi	9,582	7,717	NA	0	NA	NA
Tennessee	3,940	-108	4,591	7,566	NA	NA
West South Central	**26,473**	**23,693**	**6,065**	**7,513**	**0**	**233**
Arkansas	8,895	11,369	2,785	2,407	NA	NA
Louisiana	13,785	12,324	NA	0	NA	NA
Oklahoma	NA	NA	2,045	2,948	NA	NA
Texas	3,792	NA	1,235	2,158	0	233
Mountain	**23,600**	**13,632**	**28,072**	**33,281**	**232**	**215**
Arizona	22,940	13,458	7,771	10,119	NA	NA
Colorado	660	174	1,744	1,818	2	2
Idaho	NA	NA	6,745	8,105	NA	NA
Montana	NA	NA	8,237	8,925	55	49
Nevada	NA	NA	2,091	2,526	NA	NA
New Mexico	NA	NA	100	164	NA	NA
Utah	NA	NA	593	856	174	164
Wyoming	NA	NA	789	768	*	*
Pacific Contiguous	**43,202**	**40,263**	**126,499**	**129,693**	**10,613**	**10,985**
California	30,863	30,387	23,474	24,564	10,131	10,637
Oregon	6,339	4,348	34,646	35,431	99	0
Washington	6,000	5,528	68,379	69,698	383	348
Pacific Noncontiguous	**NA**	**NA**	**950**	**887**	**16**	**13**
Alaska	NA	NA	935	872	0	0
Hawaii	NA	NA	14	15	16	13
U.S. Total	**526,973**	**455,270**	**222,940**	**249,695**	**11,984**	**12,267**

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[1] Station losses include energy used for pumped storage. Energy used in 1988 for pumping was 23,935 gigawatthours and in 1987 was 21,921 gigawatthours.

[2] Includes geothermal, wood, wind, waste, and solar.

* Value less than 0.5 gigawatthours.

NA = Not applicable.

Notes: •Negative generation denotes that electric power consumed for plant use exceeds gross generation. •Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Fossil Fuel Statistics

This chapter contains statistics on the consumption of fossil fuels used to generate electricity, end-of-year fossil fuel stocks, and the receipts and costs of fossil fuels at steam-electric power plants with a nameplate capacity of 50 or more megawatts. These data are aggregated to the national, Census division, and State levels.

Background

Various sources of energy are used by the electric power industry to produce electricity; however, fossil fuels supply about 70 percent of the energy sources for the generation requirements of the Nation. Fossil fuels are so named because they are derived from the remains of the plants and animals, which lived on earth millions of years ago. Coal, petroleum, and natural gas are currently the dominant fossil fuels used by the industry. Other fossil fuels include petroleum coke, refinery gas, coke oven gas, blast furnace gas, and liquified petroleum gas. Statistics on consumption, purchases (receipts), and stocks of fossil fuels at electric utilities are interdependent. That is, the stocks on site at the utility at the end of the current year result from the stocks that were available at the end of the prior year, the amount of fuel purchased during the current year, and the amount of fuel consumed during the year.

Fossil Fuel Consumption and Stocks

Coal, the energy source used to generate more than one-half of the electricity needed in the Nation, is consumed extensively throughout the United States (particularly in the East North Central, West North Central, West South Central, and the South Atlantic Census Divisions). Although, on a national level, the use of petroleum for generation is not as common as during the early 1970's, some areas of the country (such as the New England and Pacific Noncontiguous Census Divisions) continue to use it extensively. Consumption of natural gas generally occurs in areas of the country where it is readily accessible, particularly in the West South Central Census Division.

Electric utilities maintain stockpiles of coal and petroleum to minimize the effect of an interruption or curtailment in fuel availability. The purposes of on-site storage are to provide an uninterrupted supply, allow bulk shipments, and take advantage of favorable market conditions. Since gas cannot be stored, no information on gas stocks is available.

Fossil Fuel Receipts and Costs

Statistics on receipts provide information regarding the delivery of fossil fuels to steam-electric plants. The costs include all costs incurred by an electric utility in the purchase and delivery of fuel to the plant. The type of contract under which a fuel is purchased has a significant effect on the price of the fuel delivered and can be used as a good indicator of market conditions. Transactions where petroleum and coal are obtained by the utility under purchase orders or contracts of more than 1-year duration are referred to as *contract purchases.* Shipments of petroleum and coal under purchase orders or contracts of less than 1-year duration are considered *spot purchases.* Transactions to secure natural gas that are conducted under a contract with uninterrupted delivery are identified as *firm purchases. Interruptible purchases* are those in which the gas is received under a contract that permits curtailment of service under certain circumstances. For example, under both Federal and State regulations, requirements for natural gas to heat homes and serve industry have priority over requirements of the electric power industry. Consequently, a contract under which gas is purchased is most generally one that allows for an interruption in its accessibility. A contract under which gas is purchased and delivered only at a specified time of the year is an *off-peak purchase.*

Coal. Coal is obtained from three major coal-producing areas in the United States. *Appalachian coal* is mined in both surface and underground mines located in Pennsylvania, Maryland, Virginia, West Virginia, eastern Kentucky, Tennessee, Alabama, and Ohio. This coal is bituminous in rank and of low-to-medium sulfur content. Its British Thermal Unit (Btu) content averages over 12,000 Btu per pound. The coal is transported primarily by train, barge, and truck to electric plants throughout the eastern United States. *Interior coal* is mined in both surface and underground mines located in Illinois, Indiana, western Kentucky, and Missouri. It is bituminous coal with a high percentage of sulfur and ash and contains approximately 11,000 Btu per pound. Most of this coal is delivered to electric plants in the central United States. *Western coal* is mined in Montana, Wyoming, Colorado, Utah, North Dakota, Arizona, and New Mexico. It is delivered to electric plants throughout the western and central United States. Over one-half of the coal in this region is subbituminous coal that is lower in sulfur content (less than 0.5 percent per pound) and contains approximately 8,000 Btu per pound. This coal originates in the Powder River basin of northeast Wyoming and southeast Montana. Coal from this region is delivered by unit train to electric plants as far east as Ohio and Georgia.

The price of coal delivered to electric utilities can vary significantly from State to State. Coal delivered to the New England Census Division from the Appalachian coal fields may cost as much as $60.00 per short ton due to transportation costs and the higher cost of eastern coal. Environmental restrictions within a State may require electric utilities to burn only the more expensive, low-sulfur coal resulting in a higher delivered price. In the West, especially in the Mountain Census Division, coal-burning plants are often built in close proximity to the mine thus reducing transportation costs. In addition, the cost of mining coal from the large surface mines found in the western United States is significantly less than that of underground eastern mines, resulting in a delivered price of under $15.00 per short ton for States such as Montana and Wyoming. Receipts of low-grade lignite at electric plants in States such as North Dakota, South Dakota, and Texas also reduces the overall delivered price of coal to well below the national average.

Petroleum. Although nationwide receipts at electric utilities are less than one half the volume of the 1970's, several electric utilities in the New England area, and in New York, Florida, California, and Hawaii still depend on petroleum for a significant portion of their fossil fuel requirements. Receipts can vary widely from year to year at electric utilities due to changes in the price of petroleum. Fuel oil Numbers 2, 4, 5, and 6 are purchased by electric utilities for use in generating electricity. Fuel oil Numbers 4, 5, and 6 (heavy oil) constitute the majority of all petroleum receipts at electric utilities. Smaller amounts of fuel oil Number 2 (light oil) are also used by electric utilities primarily for start-up and flame stabilization of the boilers.

The price of petroleum delivered to electric utilities varies considerably from State to State. The most important factor in determining price is the type of fuel oil that is being delivered. States receiving only low-grade heavy oil will show a delivered price much lower than a State receiving only light oil. Most of the petroleum delivered to the New England, Middle Atlantic, and South Atlantic Census Divisions, California, and Hawaii for use by electric utilities is the Number 6 fuel oil. In addition, the price of Number 6 fuel oil can vary due to its sulfur content. Electric utilities that are required to meet stringent environmental standards must purchase low-sulfur fuel oil at premium prices.

Natural Gas. Natural gas is used extensively as a primary fuel throughout areas of the country where it is readily accessible, for example, the West South Central Census Division and in California. Large volumes of natural gas are also transported by pipeline to the Middle Atlantic, and South Atlantic Census divisions. Gas receipts to these Census divisions and to California can vary considerably from year to year because some electric utilities switch between use of petroleum and natural gas in dual-fired generating units. The highest volume of gas receipts at electric utilities occurs during the summer months when demand for electricity peaks. In some northern parts of the United States, receipts of gas at electric utilities are limited during the winter months due to the priority for heating and industry needs. Many electric utilities have the capability of burning either petroleum or natural gas. The cost of the fuel is usually the determining factor. One major advantage of natural gas over all other fossil fuels is that it is a clean burning fuel. Therefore, some electric utilities use gas in order to comply with environmental regulations.

Petroleum Coke. Petroleum coke is the final product or residue produced from the process of breaking down complex petroleum hydrocarbons into lighter petroleum products such as gasoline (cracking).

Data Sources

The data in the following tables were obtained from two sources. The first is the Form EIA-759, "Monthly Power Plant Report," which is used to collect monthly data from all operators of electric utilities (approximately 800) in the United States. More detailed statistics on stocks and consumption are in published the *Electric Power Monthly*.[6] The second source is the Federal Energy Regulatory Commission (FERC) Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants," which is used to collect data from approximately 225 electric utilities. More detailed statistics on receipts and costs of fossil fuels are published in the *Cost and Quality of Fuels for Electric Utility Plants*.[7] Caution should be used in comparing stock and consumption data since all power plants are surveyed by the Form EIA-759, while the FERC Form 423 is limited to power plants with a fossil fuel steam-electric nameplate capacity of 50 or more megawatts.

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[6] Energy Information Administration, *Electric Power Monthly* DOE/EIA-0226.

[7] Energy Information Administration, *Cost and Quality of Fuels for Electric Utility Plants* DOE/EIA-0191.

The average cost of coal includes the cost of transporting the coal from the mine to the utility.

Table 11. Consumption of Fossil Fuels, and Stocks of Coal and Petroleum, 1984-1988

Item	1988	1987	1986	1985	1984
Consumption					
Coal (thousand short tons)	758,372	717,894	685,056	693,841	664,399
Petroleum (thousand barrels)[1]	248,096	199,378	230,482	173,414	204,479
Gas (million cubic feet)	2,635,613	2,844,051	2,602,370	3,044,083	3,111,342
Stocks[2]					
Coal (thousand short tons)	146,507	170,797	161,806	156,376	179,727
Petroleum (thousand barrels)[1]	69,285	70,827	73,111	73,689	87,619

[1] Does not include petroleum coke.

[2] Stocks are shown as of December 31 of each year.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 12. Receipts and Average Cost of Fossil Fuels, 1984-1988

Item	1988	1987	1986	1985	1984
Receipts					
Coal (thousand short tons)	727,776	721,298	686,964	666,743	684,111
Petroleum (thousand barrels)[1]	236,923	194,578	228,522	164,946	202,372
Gas (million cubic feet)	2,362,721	[R] 2,605,191	[R] 2,387,622	[R] 2,808,921	[R] 2,878,808
Cost (dollars)					
Coal (per short ton)	30.64	31.83	33.30	34.53	35.12
Contract	30.86	32.01	33.51	34.63	35.06
Spot	29.30	30.86	31.81	33.73	35.49
Petroleum (per barrel)[1]	15.33	19.06	15.30	27.08	30.47
Contract	15.36	[R] 19.15	15.56	27.18	30.46
Spot	15.25	18.73	14.54	26.44	30.56
Gas (per thousand cubic foot)	2.33	2.31	[R] 2.43	[R] 3.58	[R] 3.73
Firm	2.22	[R] 2.31	[R] 2.41	[R] 3.20	[R] 3.18
Interruptible[2]	2.47	2.32	2.47	4.11	4.65

[1] Does not include petroleum coke.

[2] Includes off-peak gas.

R = Revised data.

Notes: •Data are for plants with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts. •Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

Table 13. Consumption of Fossil Fuels by Census Division and State, 1988 and 1987

Census Division State	Coal (thousand short tons)		Petroleum[1] (thousand barrels)		Gas (million cubic feet)	
	1988	1987	1988	1987	1988	1987
New England	**6,330**	**6,217**	**62,087**	**53,302**	**21,374**	**52,884**
Connecticut	854	787	18,500	15,732	1,260	7,350
Maine	NA	NA	4,906	4,351	NA	NA
Massachusetts	4,260	4,267	32,198	28,739	19,874	40,183
New Hampshire	1,217	1,163	4,870	3,576	55	15
Rhode Island	0	0	1,538	832	185	5,336
Vermont	NA	0	75	71	NA	0
Middle Atlantic	**55,059**	**52,172**	**86,859**	**71,030**	**202,208**	**250,458**
New Jersey	2,773	3,081	9,204	5,695	51,066	75,138
New York	9,120	7,828	65,002	52,538	148,493	173,328
Pennsylvania	43,166	41,263	12,653	12,797	2,649	1,993
East North Central	**163,462**	**161,833**	**7,002**	**6,315**	**27,901**	**18,288**
Illinois	26,681	28,894	2,559	3,660	5,706	3,172
Indiana	40,060	36,987	379	352	3,455	1,315
Michigan	29,968	30,854	2,915	1,522	15,027	10,754
Ohio	48,893	47,520	921	608	974	871
Wisconsin	17,861	17,579	229	173	2,739	2,176
West North Central	**101,097**	**89,174**	**1,126**	**770**	**33,459**	**28,241**
Iowa	13,921	12,997	123	115	5,459	3,265
Kansas	14,742	14,942	283	156	18,890	16,074
Minnesota	16,259	13,495	137	101	5,217	5,700
Missouri	24,356	23,012	339	232	1,623	1,379
Nebraska	7,744	6,428	140	92	2,046	1,743
North Dakota	21,686	17,434	46	50	2	3
South Dakota	2,388	865	58	23	223	77
South Atlantic	**128,628**	**125,582**	**58,853**	**47,970**	**168,894**	**199,769**
Delaware	2,420	2,449	4,365	2,596	2,824	7,847
District of Columbia	NA	NA	1,100	616	NA	NA
Florida	23,528	22,598	40,660	33,694	154,550	175,675
Georgia	26,513	27,130	494	361	1,569	826
Maryland	9,020	8,228	6,866	5,170	5,336	11,757
North Carolina	17,766	17,255	458	435	1,068	1,162
South Carolina	9,210	9,019	195	116	2,378	538
Virginia	8,469	8,297	4,357	4,599	1,096	1,724
West Virginia	31,704	30,605	356	383	73	239
East South Central	**77,689**	**74,573**	**1,906**	**694**	**36,512**	**42,930**
Alabama	20,002	20,746	174	58	2,574	1,474
Kentucky	31,818	28,569	202	225	452	336
Mississippi	4,859	4,562	1,166	188	33,261	41,119
Tennessee	21,010	20,697	365	222	225	0
West South Central	**121,919**	**113,455**	**2,252**	**1,270**	**1,493,530**	**1,516,669**
Arkansas	12,295	11,764	265	10	22,075	32,057
Louisiana	12,301	10,029	543	118	250,323	246,912
Oklahoma	14,435	12,861	60	68	177,222	187,895
Texas	82,889	78,802	1,384	1,073	1,043,910	1,049,804
Mountain	**98,351**	**89,145**	**1,628**	**1,411**	**66,203**	**60,855**
Arizona	13,932	12,706	219	432	25,328	26,665
Colorado	15,087	14,178	84	90	8,488	7,826
Idaho	NA	NA	1	*	0	3
Montana	10,410	7,530	63	44	286	478
Nevada	8,153	6,807	945	459	10,658	7,076
New Mexico	14,661	14,340	94	83	21,064	18,454
Utah	12,544	11,175	103	187	196	263
Wyoming	23,563	22,408	121	115	183	90
Pacific Contiguous	**5,561**	**5,468**	**12,649**	**3,694**	**554,691**	**643,428**
California	NA	NA	12,631	3,674	552,938	643,335
Oregon	0	0	1	2	0	0
Washington	5,561	5,468	16	18	1,753	93
Pacific Noncontiguous	**276**	**274**	**13,732**	**12,923**	**30,841**	**30,530**
Alaska	276	274	688	727	30,841	30,530
Hawaii	NA	NA	13,044	12,196	0	*
U.S. Total	**758,372**	**717,894**	**248,096**	**199,378**	**2,635,613**	**2,844,051**

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[1] Does not include petroleum coke. Petroleum coke consumption in 1988 was 409 thousand short tons and in 1987 was 348 thousand short tons.

* Value less than 0.5 thousand barrels or 0.5 million cubic feet.

NA = Not applicable.

Note. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 14. Coal and Petroleum Stocks by Census Division and State, as of December 31, 1988 and 1987

Census Division State	Coal (thousand short tons)		Petroleum[1] (thousand barrels)	
	1988	1987	1988	1987
New England	**1,110**	**1,012**	**5,424**	**5,529**
Connecticut	0	0	2,122	1,955
Maine	NA	NA	647	481
Massachusetts	737	677	2,167	2,629
New Hampshire	344	307	313	207
Rhode Island	28	28	135	220
Vermont	NA	0	41	36
Middle Atlantic	**13,757**	**17,764**	**14,980**	**14,664**
New Jersey	528	842	2,848	2,261
New York	1,432	1,889	10,336	9,586
Pennsylvania	11,798	15,034	1,796	2,817
East North Central	**39,549**	**45,855**	**3,424**	**4,018**
Illinois	9,179	8,861	1,790	1,988
Indiana	9,997	13,185	185	257
Michigan	8,991	9,751	876	1,173
Ohio	7,218	9,959	377	335
Wisconsin	4,165	4,099	196	265
West North Central	**19,950**	**21,904**	**1,865**	**1,973**
Iowa	4,456	4,507	227	246
Kansas	3,300	3,286	668	721
Minnesota	2,579	3,346	135	125
Missouri	4,541	4,958	413	443
Nebraska	1,593	1,880	293	282
North Dakota	3,166	3,586	57	66
South Dakota	314	341	73	89
South Atlantic	**23,741**	**29,878**	**11,788**	**14,760**
Delaware	498	438	505	691
District of Columbia	NA	NA	121	115
Florida	4,804	3,196	6,562	7,672
Georgia	5,288	6,505	604	642
Maryland	1,476	1,604	1,374	1,916
North Carolina	3,727	4,465	227	238
South Carolina	1,661	1,968	430	463
Virginia	1,211	2,300	1,808	2,814
West Virginia	5,077	9,401	156	210
East South Central	**13,351**	**18,183**	**1,580**	**1,610**
Alabama	4,462	4,450	156	137
Kentucky	4,124	7,679	126	116
Mississippi	870	837	861	830
Tennessee	3,895	5,217	437	526
West South Central	**16,272**	**17,757**	**8,388**	**8,838**
Arkansas	1,899	2,329	247	468
Louisiana	2,772	2,803	1,351	1,400
Oklahoma	2,678	3,634	455	296
Texas	8,922	8,992	6,336	6,674
Mountain	**17,079**	**17,265**	**1,899**	**2,008**
Arizona	4,187	3,813	848	855
Colorado	3,763	3,635	283	386
Idaho	NA	NA	8	46
Montana	913	851	20	13
Nevada	1,434	1,782	460	413
New Mexico	1,392	1,246	210	220
Utah	2,772	3,133	34	40
Wyoming	2,619	2,805	36	36
Pacific Contiguous	**1,696**	**1,176**	**18,795**	**16,339**
California	NA	NA	18,401	15,935
Oregon	786	561	149	151
Washington	910	615	246	253
Pacific Noncontiguous	**3**	**4**	**1,141**	**1,090**
Alaska	3	4	243	247
Hawaii	NA	NA	899	843
U.S. Total	**146,507**	**170,797**	**69,285**	**70,827**

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[1] Does not include petroleum coke. Petroleum coke stocks at the end of 1988 were 86 thousand short tons and in 1987 were 51 thousand short tons.

NA = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

Table 15. Fossil Fuel Receipts by Census Division and State, 1988 and 1987

Census Division State	Coal (thousand short tons)		Petroleum[1] (thousand barrels)		Gas[2] (million cubic feet)	
	1988	1987	1988	1987	1988	1987
New England	**6,377**	**5,774**	**60,107**	**50,712**	**14,978**	**44,762**
Connecticut	830	770	18,511	15,100	1,260	7,370
Maine	NA	NA	5,120	4,061	NA	NA
Massachusetts	4,285	3,889	29,932	27,335	13,552	31,682
New Hampshire	1,262	1,116	5,130	3,385	NA	NA
Rhode Island	NA	NA	1,416	832	166	5,711
Vermont	NA	NA	NA	NA	NA	NA
Middle Atlantic	**51,532**	**53,855**	**87,220**	**72,696**	**176,698**	**218,018**
New Jersey	2,477	2,691	13,664	8,574	34,051	52,672
New York	8,562	8,131	63,074	52,077	142,255	165,095
Pennsylvania	40,493	43,033	10,483	12,046	392	251
East North Central	**155,300**	**162,093**	**5,455**	**6,105**	**22,216**	**15,302**
Illinois	26,921	28,509	1,803	3,951	4,521	2,419
Indiana	36,414	38,682	324	277	3,074	1,089
Michigan	28,344	29,889	2,389	1,361	13,141	10,400
Ohio	46,009	48,385	823	432	478	530
Wisconsin	17,613	16,629	116	85	1,003	864
West North Central	**99,540**	**89,342**	**724**	**602**	**22,480**	**19,343**
Iowa	13,974	13,786	77	69	3,844	2,639
Kansas	14,798	15,033	133	74	12,923	10,835
Minnesota	15,451	12,793	16	30	3,370	3,570
Missouri	23,959	22,533	350	349	702	858
Nebraska	7,485	6,327	101	25	1,640	1,438
North Dakota	21,714	18,128	38	47	1	4
South Dakota	2,160	741	9	8	NA	NA
South Atlantic	**120,976**	**129,921**	**53,894**	**48,333**	**138,859**	**170,015**
Delaware	2,525	2,422	4,016	2,760	1,304	7,856
District of Columbia	NA	NA	959	543	NA	NA
Florida	23,770	22,553	39,073	33,527	129,897	149,939
Georgia	25,135	26,351	374	400	1,334	805
Maryland	8,854	8,187	5,635	4,742	3,874	8,687
North Carolina	16,795	17,829	229	265	NA	NA
South Carolina	9,002	9,354	112	116	1,664	236
Virginia	7,459	8,907	3,183	5,536	700	2,404
West Virginia	27,436	34,317	312	445	86	88
East South Central	**73,868**	**78,047**	**1,569**	**747**	**29,958**	**37,609**
Alabama	19,895	20,739	140	191	1,080	858
Kentucky	29,344	31,771	223	239	400	319
Mississippi	4,870	4,430	1,087	186	28,479	36,431
Tennessee	19,759	21,107	118	132	NA	NA
West South Central	**117,144**	**111,029**	**1,472**	**748**	**1,402,134**	**1,455,725**
Arkansas	11,907	11,709	240	144	21,976	32,067
Louisiana	12,078	10,627	510	91	237,906	238,150
Oklahoma	13,355	12,124	173	35	151,747	155,820
Texas	79,803	76,568	549	478	990,506	1,029,689
Mountain	**97,184**	**86,382**	**1,500**	**1,051**	**46,002**	**40,891**
Arizona	14,121	12,714	204	296	11,179	13,931
Colorado	14,949	13,367	13	31	5,205	5,022
Idaho	NA	NA	NA	NA	NA	NA
Montana	10,474	7,596	37	24	281	477
Nevada	7,886	6,893	986	467	9,151	6,166
New Mexico	14,522	14,176	97	70	20,002	15,201
Utah	12,256	11,801	34	47	NA	5
Wyoming	22,976	19,834	128	117	185	90
Pacific Contiguous	**5,856**	**4,856**	**14,984**	**3,210**	**509,394**	**603,526**
California	NA	NA	14,967	3,194	509,394	603,526
Oregon	235	377	NA	NA	NA	NA
Washington	5,621	4,479	17	16	NA	NA
Pacific Noncontiguous	**NA**	**NA**	**10,000**	**10,374**	**NA**	**NA**
Alaska	NA	NA	NA	NA	NA	NA
Hawaii	NA	NA	10,000	10,374	NA	NA
U. S. Total	**727,776**	**721,298**	**236,923**	**194,578**	**2,362,721**	**2,605,191**

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[1] Does not include petroleum coke. Petroleum coke receipts in 1988 were 356 thousand short tons and in 1987 were 299 thousand short tons.

[2] Data for 1987 have been revised to reflect the elimination of data for gas turbine units.

NA = Not applicable.

Notes: •Data are for plants with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts. •Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

Table 16. Average Cost of Fossil Fuel Receipts by Census Division and State, 1988 and 1987

Census Division State	Coal			Petroleum[1]			Gas[2]		
	1988		1987	1988		1987	1988		1987
	($ per short ton)	(Cents per 10^6 Btu)	(Cents per 10^6 Btu)	($ per barrel)	(Cents per 10^6 Btu)	(Cents per 10^6 Btu)	($ per Mcf)	(Cents per 10^6 Btu)	(Cents per 10^6 Btu)
New England	**45.59**	**173.2**	**178.1**	**14.37**	**227.5**	**278.9**	**2.28**	**221.6**	**238.3**
Connecticut	60.07	228.6	242.0	15.11	239.7	293.6	2.24	217.4	236.6
Maine	NA	NA	NA	14.74	235.3	293.7	NA	NA	NA
Massachusetts	42.25	161.2	161.4	14.25	225.9	271.5	2.29	222.2	239.9
New Hampshire	47.38	177.7	191.8	12.13	186.9	258.7	NA	NA	NA
Rhode Island	NA	NA	NA	14.24	224.6	267.8	2.15	208.6	231.8
Vermont	NA	NA	NA	NA	NA	NA	NA	NA	NA
Middle Atlantic	**36.92**	**148.8**	**147.6**	**15.63**	**248.9**	**306.7**	**2.31**	**224.0**	**246.8**
New Jersey	45.75	171.7	176.8	15.63	251.2	312.2	2.32	224.5	255.0
New York	40.52	158.1	154.3	15.66	248.9	306.1	2.30	223.6	244.1
Pennsylvania	35.62	145.3	144.3	15.48	245.8	305.5	3.45	333.0	334.9
East North Central	**35.70**	**160.4**	**164.2**	**18.47**	**301.8**	**361.2**	**1.50**	**295.7**	**313.6**
Illinois	40.53	190.6	200.0	19.42	312.0	361.6	3.34	326.9	365.6
Indiana	31.03	143.2	146.7	20.93	363.4	412.2	2.60	259.1	282.2
Michigan	40.80	175.7	175.3	17.14	279.9	337.5	.41	255.5	276.3
Ohio	36.22	152.2	156.0	18.90	311.7	395.7	3.51	346.5	304.4
Wisconsin	28.39	146.4	147.2	21.07	364.5	396.8	3.26	325.2	392.0
West North Central	**20.11**	**115.4**	**120.5**	**16.90**	**276.9**	**322.8**	**2.10**	**210.9**	**221.7**
Iowa	22.74	123.5	124.6	21.51	372.1	405.7	2.04	202.7	215.4
Kansas	22.25	123.9	126.7	19.01	318.6	387.0	2.05	206.0	217.5
Minnesota	20.91	119.6	120.6	21.29	369.2	446.6	1.99	198.4	207.5
Missouri	28.75	138.2	141.3	14.77	237.0	279.6	2.75	277.0	296.1
Nebraska	14.49	84.1	94.5	15.14	241.7	250.2	2.56	268.6	256.3
North Dakota	9.26	70.3	79.3	21.07	362.1	428.1	4.56	428.6	443.4
South Dakota	15.39	121.4	123.4	23.62	401.7	[illegible]	NA	NA	NA
South Atlantic	**41.54**	**166.5**	**166.5**	**14.40**	**227.7**	**298.1**	**2.14**	**212.2**	**271.6**
Delaware	46.60	180.6	181.1	14.71	232.1	278.7	2.59	242.1	274.5
District of Columbia	NA	NA	NA	16.82	278.9	354.8	NA	NA	NA
Florida	44.16	177.7	R 181.4	14.07	221.3	292.2	2.12	210.1	271.4
Georgia	42.53	174.7	178.9	17.02	283.8	344.9	2.80	273.4	371.5
Maryland	40.12	157.6	157.7	14.90	236.1	311.4	2.71	259.7	268.1
North Carolina	44.65	177.5	179.0	20.25	348.5	390.8	NA	NA	NA
South Carolina	44.63	176.0	174.0	21.72	373.6	400.0	1.86	180.6	334.5
Virginia	39.72	155.1	158.1	14.61	236.3	309.3	2.16	204.9	242.3
West Virginia	35.95	144.1	142.2	23.23	395.8	436.1	3.89	389.2	393.6
East South Central	**35.36**	**148.4**	**151.2**	**20.93**	**340.3**	**359.5**	**1.91**	**186.3**	**186.5**
Alabama	47.37	194.7	192.4	21.01	366.8	403.1	2.15	207.1	210.2
Kentucky	27.61	119.8	125.8	22.45	384.6	407.3	2.52	246.0	278.1
Mississippi	45.88	181.2	195.5	20.67	327.7	237.6	1.90	184.7	185.1
Tennessee	32.17	133.5	136.7	20.39	350.9	392.8	NA	NA	NA
West South Central	**23.06**	**149.5**	**156.2**	**21.14**	**345.5**	**366.3**	**2.15**	**207.8**	**204.1**
Arkansas	27.47	158.5	155.2	26.44	435.4	386.0	1.39	135.0	152.2
Louisiana	25.48	155.5	164.4	21.48	347.6	340.5	1.70	163.1	160.0
Oklahoma	26.42	148.2	155.7	16.88	268.2	391.2	2.92	281.3	267.4
Texas	21.50	147.2	155.2	19.83	329.1	363.7	2.16	209.0	206.3
Mountain	**21.32**	**109.5**	**112.1**	**17.68**	**289.4**	**334.5**	**2.35**	**229.4**	**231.3**
Arizona	29.92	140.5	129.9	24.01	407.0	426.2	2.32	224.1	220.3
Colorado	20.84	106.6	111.8	22.14	384.8	386.3	2.25	228.7	228.6
Idaho	NA	NA	NA	NA	NA	NA	NA	NA	NA
Montana	9.29	54.5	64.8	23.88	403.3	410.7	1.53	126.3	91.9
Nevada	30.21	136.3	139.9	15.25	244.8	245.0	2.79	271.8	258.0
New Mexico	21.24	117.5	120.8	18.10	308.0	357.0	2.19	213.6	235.8
Utah	29.07	126.5	125.2	23.43	398.4	411.9	NA	NA	507.4
Wyoming	14.71	84.0	87.0	22.22	379.7	409.5	3.78	367.9	326.1
Pacific Contiguous	**25.41**	**154.5**	**164.9**	**16.35**	**266.0**	**282.6**	**2.93**	**283.1**	**250.1**
California	NA	NA	NA	16.34	265.8	282.0	2.93	283.1	250.1
Oregon	23.70	139.0	140.2	NA	NA	NA	NA	NA	NA
Washington	25.48	155.2	167.1	23.87	403.2	409.8	NA	NA	NA
Pacific Noncontiguous	**NA**	**NA**	**NA**	**17.96**	**286.7**	**344.6**	**NA**	**NA**	**NA**
Alaska	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hawaii	NA	NA	NA	17.96	286.7	344.6	NA	NA	NA
U. S. Total	**30.64**	**146.6**	**150.6**	**15.33**	**243.9**	**301.1**	**2.33**	**226.3**	**224.0**

[1] Does not include petroleum coke. Petroleum coke cost in 1988 was 97.2 cents per million Btu and in 1987 was 101.9 cents per million Btu.

[2] Data for 1987 have been revised to reflect the elimination of data for gas turbine units.

Mcf = thousand cubic feet.

R = Revised data.

NA = Not applicable.

Notes: •Data are for plants with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts. •Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

Retail Sales and Revenue

This chapter provides summary statistics on the sale of electricity to ultimate consumers, and on revenue and retail prices from the sale of electricity. This information is provided at the national, Census division, and State levels.

Background

Electric power is an integral part of our way of life. It is indispensable to the factory, the commercial establishment, the home, and even most recreational facilities. The unavailability of electric power causes inconvenience to customers, loss of industrial production, and even danger to individuals and social disorder.

Because electricity itself cannot be stored, it must be generated, transmitted to the consumer, and consumed instantaneously. Electric companies were formed to provide these services. The electric system consists of energy conversion plants (stations) that convert different forms of energy to electric power; transformers to raise the voltage in order to reduce losses in transmitting the power; transmission lines to transmit the power to the general vicinity of consumption; transformers to lower the voltage; and distribution lines to distribute the power to the ultimate consumers. The entire system of generating stations, transformers, transmission lines, distribution lines, etc., is known as a power system. Power companies plan, build and design, and operate this power system. Some companies may only operate part of a power system. For example, many small power companies only distribute power to ultimate consumers, buying their power from other companies that generate power. Power systems are interconnected for mutual operating and economic advantages.

Electric utilities are high-investment businesses. Historically, they have been treated as monopolies because duplicate facilities, particularly transmission and distribution lines, would be inefficient. Thus, franchises are granted to electric utilities for given geographical areas by regulatory officials. To obtain a franchise, electric utilities must provide service to all consumers in their territories at a reasonable cost.

The service territory of an electric utility is usually composed of many different combinations of consumers. Electric utilities classify their consumers by different factors such as demand, rate schedule, Standard Industrial Classification (SIC) code, distribution voltage, accounting methods, end-use applications, and other social and economic characteristics. Electric utilities use consumer classifications for planning (load growth, peak demands) and for constructing their rate schedules, often with the approval of a government regulatory agency.

Revenue Requirements

Revenue requirements are set to reimburse the electric utility for providing electric service. The revenue requirement is the anticipated cost of providing services for some period of time in the future, usually a year. The process of determining electricity prices generally follows three stages: revenue requirements are determined; the requirements are allocated to different classes of service or consumer; and rate schedules for each class of consumer are determined.

The rate schedules developed to generate revenue requirements for electric utilities are unique to each utility. The authority for the approval of these rates is based on the ownership class applicable to the utility. For example, privately owned (investor-owned) electric utilities are regulated by State public service commissions and the Federal Energy Regulatory Commission. Publicly owned electric utilities, in most States, are controlled through locally elected or appointed officials. A more detailed discussion on utility classes of ownership is contained in the "Industry Profile" section in the first chapter of this publication.

A rate schedule is a statement that the utility will provide service to a particular class of consumer at a certain price. Prices between classes of service vary based on various objectives of the utility. These objectives include the need to allocate costs incurred in providing service, to maintain the existing customers of the utility, and to promote new business.

Classes of Consumers

Consumers within an electric utility's service territory are generally grouped into classes -- residential, commercial, industrial, and other (public street and highway lighting, railroads and railways, municipalities, divisions or agencies of State and Federal governments under special contracts or agreements, and other utility departments) as defined by the pertinent regulatory agency and/or electric utility. The categorization of consumer is determined by the electric utility based on its service territory, size, location, ownership, and regulatory structure.

The residential sector includes electricity supplied to private household establishments and apartment buildings, where energy is consumed primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, and clothes drying.

The commercial sector may include electricity supplied to nonmanufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, and retail stores; and, health, social, and educational institutions. However, electric utilities may classify commercial service as all consumers whose demand or annual usage fall within some specified limit. The limit may be set by the electric utility based on its rate schedule.

The industrial sector may include electricity supplied to manufacturing, construction, mining, agriculture, fishing, and forestry establishments -- Standard Industrial Classification (SIC) codes 1-39. However, electric utilities may classify industrial service using these SIC codes, or based on demand or annual usage exceeding some specified limit. As in the commercial sector, the limit may be set by the electric utility based on its rate schedule.

Average Retail Price

The average price of electricity by class of consumer and State is calculated by dividing total annual revenue by total annual retail sales for each class and State. Average retail electricity prices to residential consumers are generally higher than to any other class of consumers due to higher costs associated with serving many consumers who use relatively small amounts of electricity. These costs include direct-load costs, such as those for distribution lines, transformers, and meters, in addition to consumer or administrative costs. The industrial classification, covering consumers with the largest usage of electricity, generally has the lowest rates due to the economies of serving a few consumers who use relatively large amounts of electricity.

Because of the type and availability of capacity, and the cost of fuel, average retail prices for electricity differ across U. S. Census divisions. The New England and Middle Atlantic Census Divisions tend to have retail prices that are higher than average in part because of their reliance on petroleum-fired generation. Petroleum is generally a more expensive energy source than coal and natural gas. The East and West South Central divisions rely on gas-fired generation and the East North Central and South Atlantic divisions rely on coal-fired generation. Because they rely on inexpensive hydroelectric generation, average retail prices in the Mountain and Pacific Contiguous Census Divisions are usually below the national average for all classes of consumers.

Data Sources

Summary statistics on electricity sales to ultimate consumers, revenue from these sales, and average retail prices are provided in the following tables. These data were obtained from the Form EIA-861, "Annual Electric Utility Report." The Form EIA-861 is used to collect annual data from all electric utilities (approximately 3,250), that own and/or operate facilities within the United States, its territories, and Puerto Rico, for the generation, transmission, distribution, or sale of electric energy primarily for use by the public. More detailed statistics are published in the *Typical Electric Bills.*[8]

The annual sales and revenue data shown in this publication differ somewhat from the sum of the monthly data based on information collected on the Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," and published in the *Electric Power Monthly* and previous issues of *Electric Power Annual.* Both forms use sectoral classifications based on the usual classification of consumers by electric utilities. At the national level, data collected on the Forms EIA-861 (a census of electric utilities) and EIA-826 (a statistical sample of electric utilities derived from the Form EIA-861) correspond fairly closely. However, some large differences have been observed at the State level, particularly for Tennessee, due to a misclassification of commercial and industrial data on the Form EIA-826 (see item 10 in Appendix C).

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[8] Energy Information Administration, *Typical Electric Bills*, DOE/EIA-0040.

Table 17. Sales of Electricity and Revenue from Electricity Sales to Ultimate Consumers by Sector, 1984-1988

Item	1988	1987	1986	1985	1984
Sales (gigawatthours)[1]					
Residential	892,866	850,410	819,088	793,934	780,092
Commercial	699,100	660,433	630,520	605,989	582,621
Industrial	896,498	858,233	830,531	836,772	837,836
Other[2]	89,598	88,196	88,615	87,279	85,248
U.S. Total	**2,578,062**	**2,457,272**	**2,368,753**	**2,323,974**	**2,285,796**
Revenue (thousand dollars)					
Residential	66,790,048	63,317,819	60,773,059	58,710,087	55,815,430
Commercial	49,223,738	46,786,529	45,385,680	44,081,872	41,535,757
Industrial	42,145,316	40,949,358	40,982,139	41,579,920	40,466,067
Other[2]	5,550,938	5,478,744	5,411,963	5,312,385	5,031,272
U.S. Total	**163,710,040**	**156,532,450**	**152,552,841**	**149,684,264**	**142,848,526**

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[1] The Form EIA-861 data shown in this publication differ somewhat from Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," data published in the *Electric Power Monthly* and previous issues of this publication. See Appendix D for a detailed description of these differences.

[2] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 18. Average Retail Electricity Prices by Sector, 1984-1988

(Cents Per Kilowatthour)

Sector	1988	1987	1986	1985	1984
Residential	7.48	7.45	7.42	7.39	7.15
Commercial	7.04	7.08	7.20	7.27	7.13
Industrial	4.70	4.77	4.93	4.97	4.83
Other[1]	6.20	6.21	6.11	6.09	5.90
U.S. Average	**6.35**	**6.37**	**6.44**	**6.44**	**6.25**

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[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Notes: •Average retail prices are calculated by dividing electricity sales into revenue. •Totals may not equal sum of components because of independent rounding. •The Form EIA-861 data shown in this publication differ somewhat from Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," data published in the *Electric Power Monthly* and previous issues of this publication. See Appendix D for a detailed description of these differences.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 19. Sales of Electricity to Ultimate Consumers by Sector, Census Division, and State, 1988 and 1987
(Gigawatthours)

Census Division State	Total		Residential		Commercial		Industrial		Other[1]	
	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987
New England	**102,398**	**97,235**	**37,069**	**34,727**	**36,169**	**34,220**	**27,209**	**26,471**	**1,949**	**1,817**
Connecticut	26,923	25,721	10,300	9,670	9,961	9,445	6,305	6,251	356	356
Maine	11,264	10,718	3,904	3,726	2,569	2,473	4,616	4,351	175	168
Massachusetts	44,727	42,383	15,511	14,475	17,886	16,897	10,243	10,043	1,087	967
New Hampshire	8,848	8,373	3,464	3,261	1,947	1,814	3,339	3,202	99	96
Rhode Island	6,220	5,942	2,319	2,186	2,354	2,209	1,361	1,360	186	187
Vermont	4,416	4,097	1,572	1,409	1,453	1,381	1,345	1,264	46	43
Middle Atlantic	**300,646**	**284,856**	**95,945**	**90,363**	**99,075**	**93,173**	**92,290**	**88,380**	**13,337**	**12,939**
New Jersey	62,112	58,746	20,656	19,308	25,143	23,307	15,844	15,665	469	467
New York	125,643	118,970	37,460	35,294	46,598	43,915	30,155	28,726	11,430	11,035
Pennsylvania	112,891	107,140	37,828	35,761	27,334	25,952	46,291	43,989	1,438	1,438
East North Central	**446,415**	**426,752**	**136,879**	**129,338**	**106,280**	**99,378**	**188,530**	**183,901**	**14,726**	**14,135**
Illinois	110,041	104,789	33,980	31,995	30,551	28,964	37,942	36,575	7,568	7,255
Indiana	71,675	67,624	22,486	21,171	15,058	12,815	33,474	32,999	657	639
Michigan	82,517	78,980	25,316	24,032	19,530	18,587	36,324	35,098	1,346	1,263
Ohio	134,316	130,383	38,713	36,711	29,004	27,612	62,238	61,855	4,360	4,204
Wisconsin	47,866	44,976	16,383	15,429	12,137	11,401	18,552	17,374	794	773
West North Central	**183,221**	**171,845**	**68,909**	**64,655**	**48,105**	**45,344**	**61,151**	**57,087**	**5,055**	**4,759**
Iowa	28,838	27,026	10,677	10,045	6,320	5,943	11,025	10,264	816	774
Kansas	25,829	24,430	9,121	8,617	8,583	8,155	7,708	7,266	417	392
Minnesota	45,728	41,776	14,996	13,834	7,792	7,285	22,131	19,911	808	746
Missouri	52,227	50,120	21,339	20,312	17,534	16,468	12,552	12,554	802	787
Nebraska	17,259	16,185	6,813	6,378	4,996	4,779	4,104	3,851	1,346	1,176
North Dakota	7,107	6,597	3,050	2,788	1,521	1,469	2,070	1,839	466	501
South Dakota	6,235	5,711	2,913	2,680	1,359	1,246	1,562	1,402	400	382
South Atlantic	**499,926**	**477,577**	**199,187**	**190,899**	**139,545**	**131,557**	**145,387**	**139,820**	**15,806**	**15,301**
Delaware	7,543	7,015	2,533	2,329	2,109	1,939	2,854	2,701	47	46
District of Columbia	9,380	9,007	1,465	1,410	4,793	4,580	2,809	2,708	312	309
Florida	130,241	122,468	63,972	60,406	45,892	42,814	16,356	15,443	4,021	3,805
Georgia	74,346	71,680	27,609	26,991	19,850	18,640	25,984	25,227	903	822
Maryland	47,564	44,908	18,483	17,218	11,006	10,337	17,446	16,745	628	608
North Carolina	85,540	82,610	32,212	31,507	21,513	20,505	30,211	28,993	1,604	1,604
South Carolina	52,809	51,967	17,172	16,913	10,790	10,292	24,113	24,036	734	725
Virginia	70,115	66,847	28,192	26,875	18,768	17,788	15,690	14,899	7,465	7,285
West Virginia	22,388	21,075	7,549	7,250	4,823	4,661	9,925	9,067	91	96
East South Central	**211,667**	**202,406**	**75,826**	**73,963**	**33,457**	**32,265**	**97,750**	**91,691**	**4,634**	**4,487**
Alabama	56,638	54,703	19,641	19,294	9,588	9,371	26,758	25,478	651	559
Kentucky	54,078	50,787	16,811	16,080	8,439	7,928	26,446	24,459	2.382	2,320
Mississippi	28,080	27,186	11,415	11,129	5,928	5,733	10,115	9,683	622	641
Tennessee	72,872	69,730	27,960	27,460	9,502	9,234	34,431	32,071	980	966
West South Central	**346,955**	**335,515**	**121,809**	**118,148**	**88,168**	**84,299**	**124,788**	**120,999**	**12,189**	**12,069**
Arkansas	25,273	24,196	9,946	9,708	5,783	5,562	8,931	8,358	613	569
Louisiana	60,011	59,156	20,134	19,986	13,088	12,524	23,559	22,986	3,230	3,660
Oklahoma	37,326	36,096	14,475	14,085	10,100	9,691	10,719	10,417	2.032	1,903
Texas	224,346	216,066	77,255	74,369	59,197	56,523	81,579	79,238	6.315	5,937
Mountain	**150,269**	**142,232**	**47,309**	**44,844**	**46,269**	**43,827**	**49,820**	**46,888**	**6,870**	**6,673**
Arizona	38,916	36,639	14,731	13,821	12,346	11,791	9,261	8,494	2.578	2.533
Colorado	29,335	28,071	9,551	9,218	12,683	11,843	6,295	6,216	806	795
Idaho	17,165	16,106	5,449	5,209	4,562	4,337	6,807	6,286	346	274
Montana	12,942	12,423	3,301	3,139	2,620	2,495	6,438	6,304	582	484
Nevada	13,684	12,754	4,968	4,537	3,489	3,267	4,685	4,480	543	470
New Mexico	12,755	12,332	3,394	3,306	4,264	3,982	4,032	3,855	1,065	1,189
Utah	14,507	13,397	4,151	3,980	4,244	4,086	5.321	4,555	791	776
Wyoming	10,964	10,510	1,764	1,635	2,062	2,025	6,980	6,699	158	152
Pacific	**324,782**	**307,595**	**106,181**	**99,852**	**98,233**	**92,749**	**105,531**	**99,193**	**14,838**	**15,801**
California	200,637	192,800	64,639	60,368	70,706	66,684	54,988	54,387	10,304	11,362
Oregon	39,312	37,713	14,338	13,711	10,605	10,342	13,633	13,210	736	451
Washington	84,832	77,082	27,203	25,773	16,922	15,724	36,909	31,597	3,798	3,989
Pacific Noncontiguous	**11,784**	**11,261**	**3,751**	**3,621**	**3,799**	**3,621**	**4,041**	**3,803**	**194**	**215**
Alaska	4,065	3,962	1,599	1,548	1,785	1,737	545	520	136	157
Hawaii	7,719	7,298	2,151	2,073	2,014	1,884	3,495	3,284	58	58
U. S. Total	**2,578,062**	**2,457,272**	**892,866**	**850,410**	**699,100**	**660,433**	**896,498**	**858,233**	**89,598**	**88,196**

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[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Notes: •Totals may not equal sum of components because of independent rounding. •The Form EIA-861 data shown in this publication differ somewhat from Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," data published in the *Electric Power Monthly* and previous issues of this publication. See Appendix D for a detailed description of these differences.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 20. Average Number of Ultimate Consumers by Sector, Census Division, and State, 1988 and 1987 (Thousands)

Census Division State	Total		Residential		Commercial		Industrial		Other[1]	
	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987
New England	**5,843**	**5,708**	**5,172**	**5,058**	**600**	**577**	**26**	**26**	**46**	**46**
Connecticut	1,406	1,373	1,277	1,250	119	115	5	5	4	4
Maine	631	617	547	536	63	61	3	2	18	18
Massachusetts	2,558	2,509	2,256	2,215	275	266	13	14	14	14
New Hampshire	543	522	470	452	67	63	2	1	5	5
Rhode Island	421	412	375	367	42	40	3	3	2	2
Vermont	283	275	246	239	33	32	1	1	3	3
Middle Atlantic	**15,269**	**15,038**	**13,507**	**13,321**	**1,665**	**1,622**	**51**	**51**	**45**	**44**
New Jersey	3,223	3,158	2,834	2,780	369	358	12	12	8	8
New York	6,974	6,881	6,145	6,072	790	770	10	10	29	28
Pennsylvania	5,072	5,000	4,529	4,468	506	495	29	29	8	8
East North Central	**17,900**	**17,670**	**16,065**	**15,876**	**1,690**	**1,651**	**69**	**74**	**76**	**69**
Illinois	4,725	4,675	4,273	4,232	428	421	4	4	19	19
Indiana	2,392	2,355	2,134	2,099	234	225	14	21	11	11
Michigan	3,980	3,924	3,582	3,542	368	359	15	15	16	9
Ohio	4,603	4,544	4,117	4,069	437	428	31	30	18	18
Wisconsin	2,199	2,172	1,959	1,935	223	219	6	5	12	13
West North Central	**8,190**	**8,082**	**7,106**	**7,013**	**926**	**915**	**50**	**44**	**108**	**111**
Iowa	1,293	1,288	1,122	1,119	154	153	4	4	12	12
Kansas	1,171	1,161	994	988	148	149	18	12	11	12
Minnesota	1,936	1,903	1,712	1,678	193	193	8	8	23	24
Missouri	2,359	2,316	2,089	2,052	245	238	10	12	14	14
Nebraska	786	780	646	640	101	101	4	4	34	36
North Dakota	317	312	265	262	44	42	3	3	5	5
South Dakota	328	323	277	273	40	39	2	2	8	9
South Atlantic	**19,476**	**19,110**	**17,132**	**16,660**	**2,078**	**2,213**	**86**	**82**	**179**	**155**
Delaware	297	279	267	252	28	26	1	1	1	1
District of Columbia	214	211	187	185	26	26	*	*	*	*
Florida	6,282	6,009	5,483	5,291	699	637	26	24	74	58
Georgia	2,838	2,750	2,528	2,454	274	260	20	19	17	17
Maryland	1,837	1,785	1,656	1,610	175	168	6	5	1	1
North Carolina	3,103	3,269	2,694	2,633	362	597	15	14	33	25
South Carolina	1,572	1,536	1,364	1,333	187	182	4	4	17	16
Virginia	2,489	2,411	2,215	2,148	235	225	5	4	35	33
West Virginia	844	860	739	754	92	92	10	10	3	4
East South Central	**6,811**	**6,668**	**5,979**	**5,858**	**739**	**715**	**43**	**42**	**50**	**53**
Alabama	1,840	1,806	1,616	1,585	207	201	10	10	7	10
Kentucky	1,638	1,611	1,445	1,421	169	165	9	9	16	16
Mississippi	1,115	1,080	971	941	130	125	6	6	8	7
Tennessee	2,218	2,170	1,947	1,911	234	223	18	17	19	19
West South Central	**11,879**	**11,814**	**10,238**	**10,174**	**1,345**	**1,342**	**147**	**150**	**149**	**148**
Arkansas	1,109	1,090	963	946	108	106	21	21	18	17
Louisiana	1,832	1,820	1,613	1,602	188	186	15	15	17	17
Oklahoma	1,559	1,561	1,345	1,347	187	186	15	15	13	13
Texas	7,379	7,343	6,318	6,279	862	863	96	99	102	102
Mountain	**5,977**	**5,862**	**5,162**	**5,062**	**718**	**705**	**28**	**29**	**69**	**66**
Arizona	1,534	1,482	1,354	1,308	154	150	4	4	21	20
Colorado	1,572	1,557	1,363	1,351	192	192	3	2	14	12
Idaho	464	459	390	387	67	66	4	4	3	3
Montana	412	411	339	338	57	56	3	4	13	13
Nevada	489	463	423	402	63	60	1	1	2	1
New Mexico	647	640	551	545	84	82	4	5	8	8
Utah	614	607	547	540	57	56	7	7	4	4
Wyoming	244	243	194	192	43	43	3	3	4	4
Pacific Contiguous	**14,906**	**14,523**	**13,008**	**12,674**	**1,769**	**1,725**	**47**	**45**	**83**	**79**
California	11,435	11,118	9,986	9,711	1,364	1,327	38	37	47	43
Oregon	1,323	1,304	1,129	1,111	181	180	3	2	11	11
Washington	2,148	2,101	1,892	1,852	224	219	6	6	25	25
Pacific Noncontiguous	**577**	**570**	**495**	**488**	**76**	**74**	**1**	**1**	**5**	**7**
Alaska	227	228	192	192	30	30	1	1	4	5
Hawaii	351	342	303	295	46	45	1	1	1	2
U. S. Average	**106,827**	**105,043**	**93,863**	**92,183**	**11,606**	**11,539**	**548**	**545**	**811**	**777**

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[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

* Value less than 0.5 thousand.

Notes: •Totals may not equal sum of components because of independent rounding. •The number of consumers is an average of the number of consumers at the close of each month.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 21. Revenue from Sales of Electricity to Ultimate Consumers by Sector, Census Division, and State, 1988 and 1987
(Thousand Dollars)

Census Division State	Total		Residential		Commercial		Industrial		Other[1]	
	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987
New England	**8,082,269**	**7,707,531**	**3,259,868**	**3,071,173**	**2,849,050**	**2,726,032**	**1,776,705**	**1,722,108**	**196,646**	**188,218**
Connecticut	2,254,827	2,130,055	949,622	884,920	828,340	778,575	434,172	424,969	42,693	41,591
Maine	755,124	698,371	322,215	302,384	182,210	170,514	234,202	209,637	16,497	15,836
Massachusetts	3,488,971	3,391,875	1,316,694	1,260,339	1,369,254	1,335,934	697,436	696,174	105,587	99,428
New Hampshire	731,882	664,302	327,602	296,887	168,284	151,932	224,300	204,397	11,696	11,086
Rhode Island	493,876	485,151	200,255	193,392	180,550	174,733	97,852	101,586	15,219	15,440
Vermont	357,589	337,777	143,480	133,251	120,412	114,344	88,743	85,345	4,954	4,837
Middle Atlantic	**24,063,911**	**23,233,875**	**9,225,113**	**8,787,981**	**8,669,057**	**8,338,446**	**5,117,467**	**5,034,645**	**1,052,274**	**1,072,803**
New Jersey	5,286,008	5,038,253	2,022,669	1,911,259	2,116,056	1,998,312	1,071,941	1,051,912	75,342	76,770
New York	10,735,560	10,356,369	3,919,508	3,709,766	4,492,256	4,351,287	1,489,451	1,444,679	834,345	850,637
Pennsylvania	8,042,343	7,839,253	3,282,936	3,166,956	2,060,745	1,988,847	2,556,075	2,538,054	142,587	145,396
East North Central	**27,872,324**	**27,251,286**	**10,817,023**	**10,420,948**	**7,486,078**	**7,171,149**	**8,619,796**	**8,698,124**	**949,427**	**961,065**
Illinois	8,047,729	8,152,027	3,309,031	3,254,927	2,295,062	2,329,831	1,960,137	2,064,553	483,499	502,716
Indiana	4,030,740	3,889,760	1,606,653	1,544,476	951,145	789,755	1,420,009	1,503,514	52,933	52,015
Michigan	5,449,842	5,179,870	1,873,189	1,758,683	1,491,034	1,408,806	1,975,467	1,909,916	110,152	102,465
Ohio	7,715,066	7,518,544	2,937,514	2,826,129	2,020,492	1,946,626	2,503,839	2,490,593	253,221	255,196
Wisconsin	2,628,947	2,511,085	1,090,636	1,036,733	728,345	696,131	760,344	729,548	49,622	48,673
West North Central	**10,950,131**	**10,417,319**	**4,890,865**	**4,629,852**	**3,030,837**	**2,896,159**	**2,723,066**	**2,596,935**	**305,363**	**294,373**
Iowa	1,730,544	1,687,413	809,666	785,084	414,912	406,564	456,577	445,046	49,389	50,719
Kansas	1,690,854	1,668,690	713,851	694,646	559,650	560,951	366,388	380,101	30,965	32,992
Minnesota	2,456,723	2,235,026	1,013,647	914,682	463,000	424,211	929,561	849,175	50,515	46,958
Missouri	3,374,688	3,232,611	1,563,876	1,496,485	1,135,202	1,065,784	618,482	615,043	57,128	55,299
Nebraska	915,098	864,128	405,326	381,345	271,146	259,675	158,178	149,010	80,448	74,098
North Dakota	408,758	385,755	189,591	175,386	98,626	96,796	101,725	94,417	18,816	19,156
South Dakota	373,466	343,696	194,908	182,224	88,301	82,178	72,155	64,143	18,102	15,151
South Atlantic	**30,949,919**	**29,498,709**	**14,419,533**	**13,754,063**	**9,031,076**	**8,506,282**	**6,528,186**	**6,286,155**	**971,124**	**952,209**
Delaware	502,334	448,653	212,890	192,386	146,821	129,883	138,255	122,339	4,368	4,045
District of Columbia	575,859	578,893	91,984	92,114	317,187	317,483	149,159	151,228	17,529	18,068
Florida	9,197,129	8,586,879	5,000,564	4,683,905	3,091,329	2,856,866	833,363	789,890	271,873	256,218
Georgia	4,631,545	4,258,729	1,938,687	1,823,250	1,413,872	1,255,788	1,212,819	1,119,710	66,167	59,981
Maryland	2,779,583	2,698,083	1,241,024	1,186,046	716,340	694,961	772,383	767,154	49,836	49,922
North Carolina	5,255,494	5,078,484	2,406,458	2,321,279	1,343,725	1,289,412	1,402,178	1,365,219	103,133	102,574
South Carolina	2,955,103	2,909,024	1,224,422	1,213,810	668,621	647,421	1,021,705	1,006,117	40,355	41,676
Virginia	3,977,738	3,880,164	1,855,985	1,799,325	1,070,929	1,052,726	640,378	616,232	410,446	411,881
West Virginia	1,075,134	1,059,800	447,519	441,948	262,252	261,742	357,946	348,266	7,417	7,844
East South Central	**11,670,350**	**11,127,926**	**4,571,866**	**4,383,688**	**2,088,147**	**2,001,259**	**4,738,084**	**4,486,931**	**272,253**	**256,048**
Alabama	3,133,815	3,051,099	1,276,926	1,245,199	637,053	623,362	1,183,074	1,149,796	36,762	32,742
Kentucky	2,779,209	2,628,104	951,681	915,123	452,526	434,738	1,262,622	1,166,504	112,380	111,739
Mississippi	1,734,760	1,648,652	745,987	721,848	421,941	394,015	512,154	487,006	54,678	45,783
Tennessee	4,022,566	3,800,071	1,597,272	1,501,518	576,627	549,144	1,780,234	1,683,625	68,433	65,784
West South Central	**19,762,001**	**18,970,335**	**8,481,182**	**8,138,159**	**5,414,784**	**5,123,039**	**5,113,617**	**4,972,996**	**752,418**	**736,141**
Arkansas	1,606,319	1,558,006	757,325	743,880	376,305	360,369	431,448	415,344	41,241	38,413
Louisiana	3,509,071	3,463,636	1,435,115	1,435,725	888,111	843,771	984,565	964,984	201,280	219,156
Oklahoma	2,058,115	2,024,901	974,922	949,587	586,139	577,983	392,813	397,666	104,241	99,665
Texas	12,588,496	11,923,792	5,313,820	5,008,967	3,564,229	3,340,916	3,304,791	3,195,002	405,656	378,907
Mountain	**8,846,543**	**8,301,985**	**3,419,741**	**3,202,638**	**3,001,481**	**2,823,080**	**2,067,578**	**1,934,841**	**357,743**	**341,426**
Arizona	2,886,597	2,664,457	1,289,376	1,183,154	995,430	925,971	486,627	445,356	115,164	109,976
Colorado	1,730,604	1,635,534	661,852	629,489	722,298	674,167	284,245	270,972	62,209	60,906
Idaho	634,986	593,820	258,107	239,014	188,084	180,732	175,287	162,066	13,508	12,008
Montana	531,016	497,227	179,120	173,360	124,456	122,990	204,821	181,135	22,619	19,742
Nevada	739,612	665,910	298,487	263,913	210,474	192,254	207,689	190,407	22,962	19,336
New Mexico	939,823	912,304	305,810	297,714	351,240	330,871	214,194	217,795	68,579	65,924
Utah	906,598	871,984	323,869	316,159	298,080	287,966	240,765	222,998	43,884	44,861
Wyoming	477,307	460,749	103,120	99,835	111,419	108,129	253,950	244,112	8,818	8,673
Pacific Contiguous	**20,560,117**	**19,061,494**	**7,360,546**	**6,582,016**	**7,325,337**	**6,876,198**	**5,203,564**	**4,950,896**	**670,670**	**652,384**
California	15,966,599	14,873,632	5,518,189	4,850,827	6,141,704	5,719,434	3,780,091	3,781,053	526,615	522,318
Oregon	1,692,569	1,657,400	686,388	658,350	515,388	526,149	456,868	446,683	33,925	26,218
Washington	2,900,949	2,530,462	1,155,969	1,072,839	668,245	630,615	966,605	723,160	110,130	103,848
Pacific Noncontiguous	**952,475**	**961,990**	**344,311**	**347,301**	**327,891**	**324,885**	**257,253**	**265,727**	**23,020**	**24,077**
Alaska	364,946	359,201	154,419	151,859	151,489	147,506	40,642	40,754	18,396	19,082
Hawaii	587,529	602,789	189,892	195,442	176,402	177,379	216,611	224,973	4,624	4,995
U. S. Total	**163,710,040**	**156,532,450**	**66,790,048**	**63,317,819**	**49,223,738**	**46,786,529**	**42,145,316**	**40,949,358**	**5,550,938**	**5,478,744**

[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 22. Average Retail Electricity Prices by Sector, Census Division, and State, 1988 and 1987

(Cents Per Kilowatthour)

Census Division State	Total		Residential		Commercial		Industrial		Other[1]	
	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987
New England	**7.89**	**7.93**	**8.79**	**8.84**	**7.88**	**7.97**	**6.53**	**6.51**	**10.09**	**10.36**
Connecticut	8.38	8.28	9.22	9.15	8.32	8.24	6.89	6.80	11.98	11.68
Maine	6.70	6.52	8.25	8.12	7.09	6.89	5.07	4.82	9.41	9.42
Massachusetts	7.80	8.00	8.49	8.71	7.66	7.91	6.81	6.93	9.71	10.28
New Hampshire	8.27	7.93	9.46	9.10	8.64	8.37	6.72	6.38	11.81	11.61
Rhode Island	7.94	8.16	8.63	8.85	7.67	7.91	7.19	7.47	8.20	8.27
Vermont	8.10	8.24	9.13	9.46	8.29	8.28	6.60	6.75	10.70	11.29
Middle Atlantic	**8.00**	**8.16**	**9.62**	**9.73**	**8.75**	**8.95**	**5.54**	**5.70**	**7.89**	**8.29**
New Jersey	8.51	8.58	9.79	9.90	8.42	8.57	6.77	6.72	16.07	16.45
New York	8.54	8.71	10.46	10.51	9.64	9.91	4.94	5.03	7.30	7.71
Pennsylvania	7.12	7.32	8.68	8.86	7.54	7.66	5.52	5.77	9.91	10.11
East North Central	**6.24**	**6.39**	**7.90**	**8.06**	**7.04**	**7.22**	**4.57**	**4.73**	**6.45**	**6.80**
Illinois	7.31	7.78	9.74	10.17	7.51	8.04	5.17	5.64	6.39	6.93
Indiana	5.62	5.75	7.15	7.30	6.32	6.16	4.24	4.56	8.06	8.14
Michigan	6.60	6.56	7.40	7.32	7.63	7.58	5.44	5.44	8.18	8.11
Ohio	5.74	5.77	7.59	7.70	6.97	7.05	4.02	4.03	5.81	6.07
Wisconsin	5.49	5.58	6.66	6.72	6.00	6.11	4.10	4.20	6.25	6.30
West North Central	**5.98**	**6.06**	**7.10**	**7.16**	**6.30**	**6.39**	**4.45**	**4.55**	**6.04**	**6.19**
Iowa	6.00	6.24	7.58	7.82	6.56	6.84	4.14	4.34	6.05	6.55
Kansas	6.55	6.83	7.83	8.06	6.52	6.88	5.01	5.23	7.43	8.41
Minnesota	5.37	5.35	6.76	6.61	5.94	5.82	4.20	4.26	6.25	6.29
Missouri	6.46	6.45	7.33	7.37	6.47	6.47	4.93	4.90	7.12	7.03
Nebraska	5.30	5.34	5.95	5.98	5.43	5.43	3.85	3.87	5.98	6.30
North Dakota	5.75	5.85	6.22	6.29	6.49	6.59	4.91	5.13	4.04	3.82
South Dakota	5.99	6.02	6.69	6.80	6.50	6.59	4.62	4.58	4.52	3.96
South Atlantic	**6.19**	**6.18**	**7.24**	**7.20**	**6.47**	**6.47**	**4.49**	**4.50**	**6.14**	**6.22**
Delaware	6.66	6.40	8.40	8.26	6.96	6.70	4.84	4.53	9.24	8.70
District of Columbia	6.14	6.43	6.28	6.53	6.62	6.93	5.31	5.58	5.61	5.84
Florida	7.06	7.01	7.82	7.75	6.74	6.67	5.10	5.11	6.76	6.73
Georgia	6.23	5.94	7.02	6.76	7.12	6.74	4.67	4.44	7.33	7.29
Maryland	5.84	6.01	6.71	6.89	6.51	6.72	4.43	4.58	7.93	8.22
North Carolina	6.14	6.15	7.47	7.37	6.25	6.29	4.64	4.71	6.43	6.39
South Carolina	5.60	5.60	7.13	7.18	6.20	6.29	4.24	4.19	5.50	5.75
Virginia	5.07	5.80	6.58	6.70	5.71	5.92	4.08	4.14	5.50	5.65
West Virginia	4.80	5.03	5.93	6.10	5.44	5.62	3.61	3.84	8.19	8.18
East South Central	**5.51**	**5.50**	**6.03**	**5.93**	**6.24**	**6.20**	**4.85**	**4.89**	**5.87**	**5.71**
Alabama	5.53	5.58	6.50	6.45	6.64	6.65	4.42	4.51	5.65	5.86
Kentucky	5.14	5.17	5.66	5.69	5.36	5.48	4.77	4.77	4.72	4.82
Mississippi	6.18	6.06	6.54	6.49	7.12	6.87	5.06	5.03	8.79	7.14
Tennessee	5.52	5.45	5.71	5.47	6.07	5.95	5.17	5.25	6.98	6.81
West South Central	**5.70**	**5.65**	**6.96**	**6.89**	**6.14**	**6.08**	**4.10**	**4.11**	**6.17**	**6.10**
Arkansas	6.36	6.44	7.61	7.66	6.51	6.48	4.83	4.97	6.73	6.76
Louisiana	5.85	5.86	7.13	7.18	6.79	6.74	4.18	4.20	6.23	5.99
Oklahoma	5.51	5.61	6.74	6.74	5.80	5.96	3.66	3.82	5.13	5.24
Texas	5.61	5.52	6.88	6.74	6.02	5.91	4.05	4.03	6.42	6.38
Mountain	**5.89**	**5.84**	**7.23**	**7.14**	**6.49**	**6.44**	**4.15**	**4.13**	**5.21**	**5.12**
Arizona	7.42	7.27	8.75	8.56	8.06	7.85	5.25	5.24	4.47	4.34
Colorado	5.90	5.83	6.93	6.83	5.70	5.69	4.52	4.36	7.72	7.66
Idaho	3.70	3.69	4.74	4.59	4.12	4.17	2.58	2.58	3.90	4.38
Montana	4.10	4.00	5.43	5.52	4.75	4.93	3.18	2.87	3.88	4.08
Nevada	5.40	5.22	6.01	5.82	6.03	5.88	4.43	4.25	4.23	4.12
New Mexico	7.37	7.40	9.01	9.00	6.24	8.31	5.31	5.65	6.44	5.55
Utah	6.25	6.51	7.80	7.94	7.02	7.05	4.53	4.90	5.55	5.78
Wyoming	4.35	4.38	5.85	6.11	5.40	5.34	3.64	3.64	5.58	5.70
Pacific Contiguous	**6.33**	**6.20**	**6.93**	**6.59**	**7.46**	**7.41**	**4.93**	**4.99**	**4.52**	**4.13**
California	7.96	7.71	8.54	8.04	8.69	8.58	6.87	6.95	5.11	4.60
Oregon	4.31	4.39	4.79	4.80	4.86	5.09	3.35	3.38	4.61	5.81
Washington	3.42	3.28	4.25	4.16	3.95	4.01	2.62	2.29	2.90	2.60
Pacific Noncontiguous	**8.08**	**8.54**	**9.18**	**9.59**	**8.63**	**8.97**	**6.37**	**6.99**	**11.90**	**11.19**
Alaska	8.98	9.07	9.65	9.81	8.49	8.49	7.45	7.84	13.57	12.15
Hawaii	7.61	8.26	8.83	9.43	8.76	9.42	6.20	6.85	7.98	8.60
U. S. Average	**6.35**	**6.37**	**7.48**	**7.45**	**7.04**	**7.08**	**4.70**	**4.77**	**6.20**	**6.21**

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[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales. The retail price for the Other Sector may include ownership, operation, maintenance, and rental fees for equipment and/or demand and service charges.

Notes: •Average retail prices are calculated by dividing electricity sales into revenue. •Totals may not equal sum of components because of independent rounding. •The Form EIA-861 data shown in this publication differ somewhat from Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," data published in the *Electric Power Monthly* and previous issues of this publication. See Appendix D for a detailed description of these differences.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Financial Statistics

This chapter presents data on the financial results of operations for major privately owned electric utilities. The statistical data exhibited consist of the Composite Statement of Income, the Composite Balance Sheet, Financial Indicators, and Revenue and Expense Statistics. Historical data are provided for a 3-year period.

Background

Today, virtually all the privately owned electric utilities are subject to State and Federal regulatory jurisdiction. State commissions have the authority to regulate electric rates of companies engaged in providing electric utility services to ultimate consumers (retail sales) and to oversee the issuance of mortgage bonds, debentures, notes, preferred stocks, and common stock. The Federal Energy Regulatory Commission (FERC) regulates electric rates for interstate wholesale transactions. The rate-making process is one that sets rates at levels that cover all operating expenses and taxes with a balance left over that will enable a utility to pay a fair return on funds invested by the stockholders.

A component of any economic regulatory activity is the determination of financing and accounting rules. As a consequence of regulatory jurisdiction, regulations for financing and accounting are more critical to this industry than to most other regulated industries. Both FERC and State commissions normally use quasi-judicial proceedings for financial and accounting regulation.

Composite financial data on other segments of the electric utility industry, the publicly and federally owned electric utilities and the rural electric cooperatives, are not included in this chapter. The absence of data for the nonprivately owned electric utilities has no effect on the data presented in this chapter since these electric utilities differ from the private utilities as follows: electric service is generally provided at cost for resale or to ultimate consumers; the accounting classifications do not have to conform to the Uniform System of Accounts as prescribed by the FERC for the major privately owned electric utilities; and electric utilities in these segments generally report on a fiscal rather than a calendar-year basis.

Composite Statement of Income

This statement provides a summary of the revenue collected from customers in return for services rendered within the reporting period; summarizes (in broad categories) the costs incurred by the utility in the production and delivery of electricity; and reports the net income or profit that remains for the owners of the business. Because of the somewhat unique nature of regulated electric utilities, the income statement that is standard to other nonregulated industries has been recast to reflect the reporting conventions called for in the electric power industry. For example, accounting for capital used in construction requires additional reporting on the income statement because of the perpetual nature of construction work in progress. Also, on occasion, electric utilities are required to defer the recovery of certain costs and earnings from customers until a future period. This introduces additional accounting requirements, which must be reflected on all the financial statements.

Composite Balance Sheet

A summary of plant, property, and cash owned by the electric utility, as well as the cash owed to the electric utility, are represented as assets on the composite balance sheet. The sources of funds used by electric utilities to acquire assets are also shown as liabilities and capital on the balance sheet. The standard balance sheet used in the electric power industry emphasizes capital intensity while the balance sheet used by nonregulated industries emphasizes liquidity. The balance sheet represents an accounting at a particular time, which for this chapter is the end of a calendar year.

Composite Financial Indicators

The financial statement accounts presented in this chapter represent compiled transactions resulting from the activity of the privately owned electric utilities. By comparing some of the asset and income accounts to other relevant accounts, measures of how well the electric utility industry performs in different areas can be approximated. Using the financial statement information, some basic indicators that can be used to analyze or assess the financial condition of the industry are provided. The method used to derive these selected financial indicators is ratio analysis.

Activity ratios evaluate how assets are managed. The electric utility industry is one of the most capital intensive industries in the United States and activity ratios are paramount indicators of the magnitude of their capital intensity. These ratios demonstrate the financial relationship, which exists between the assets and revenue, sales, and income that these fixed and total assets generate. Fixed-assets and total-assets turnover ratios assess the effective and efficient use of assets in the generation of income.

Leverage ratios summarize the overall debt burden and debt structure. In addition, these ratios indicate the financial ability to cover debts and how well management uses leverage to increase the value of the investment of the stockholders. The financial health of an industry is directly related to the ability of the industry to raise capital and to be able to cover their debt service obligations. In order to measure the ability to do this, a number of indicators are used. The current ratio compares current assets to current liabilities and is a measure of the liquidity. For example, do the privately owned electric utilities have sufficient cash and other assets (current), which can be quickly converted to cash to cover maturing obligations (current liabilities)? Capitalization ratios portray the financial structure and highlight the extent to which debt and other obligations are used to finance operations. The ratio of total debt to total assets shows the amount of debt that has been incurred in relationship to the total assets possessed. As the value of this ratio increases, the financial risks also become greater and more apparent. The common-stock-equity (net worth) to total-assets ratio evaluates financial strength. As net worth increases in relationship to total assets, the debt portion is decreased and financial risks are lowered. The interest-coverage ratio (without Allowance for Funds Used During Construction, a noncash source of income) is an indicator of the ability of the privately owned electric utility to ensure its payment of annual interest costs and maintain its credit ratings.

Profitability ratios indicate operating effectiveness and are used to further evaluate the management of income. The profit margin is equal to net income divided by revenue. This ratio is used extensively and represents the overall measure of income performance. Return on equity measures the rate of return on equity capital invested. Since one of the main objectives of management is to earn the highest return permissible, this r is the best single measure of the effectiveness of m agement from the perspective of the owners (sto holders). Return on investment measures the ove rate of return that has been earned on assets. This ra which is determined by dividing total assets into n income, provides an indicator of the overall finan condition.

Revenue and expense statistics are basic in any analy of the operating soundness of an electric utility. In or der to conduct this analysis, it is necessary to separat the electric utility revenue and expense informatio from other utility revenue and expense data. Emphasi is placed on total electric operating expenses. Data ar presented so that operating costs are separate from maintenance, depreciation, and taxes. For comparativ purposes, the ratio for income from utility operations is included, although ratios of electric utility operating expenses are emphasized.

Data Sources

The statistics reported in this chapter are compiled from data extracted from the FERC Form 1, "Annual Report of Electric Utilities, Licensees and Others This form is used annually to collect detailed account ing, financial, and operating data from selected pri vately owned electric utilities having, in each of the last 3 consecutive years, sales or transmission servic that exceeds any one or more of the following:

- 1 million megawatthours of total sales
- 100 megawatthours of sales for resale
- 500 megawatthours of gross interchange out
- 500 megawatthours of wheeling for others (deliv eries plus losses).

Approximately 180 electric utilities are required t submit the FERC Form 1. These major privatel owned electric utilities represent about two-thirds o all privately owned electric utilities. The electric uti ities are required to follow the Uniform System of Ac counts prescribed by the FERC (in cooperation with the National Association of Regulatory Utility Com missioners). More detailed financial statistics on pri vately, publicly, and federally owned electric utilitie and rural electric cooperatives are published in the *Fi nancial Statistics of Selected Electric Utilities*.[9]

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[9] Energy Information Administration, *Financial Statistics of Selected Electric Utilities*, DOE/EIA-0437.

Table 23. Composite Statement of Income for Selected Private Electric Utilities, 1986-1988

Description	1988 (thousand dollars)	1987 (thousand dollars)	1986 (thousand dollars)	Percent Change	
				1988/1987	1987/1986
Operating Revenue	**159,488,265**	**153,644,845**	**152,831,710**	**3.8**	**0.5**
Electric	143,930,420	138,548,938	136,257,358	3.9	1.7
Gas	14,580,945	14,113,720	15,827,564	3.3	-10.8
Other Utility	976,899	982,187	746,788	-.5	31.5
Operating Expenses	**129,730,357**	**125,560,389**	**125,605,659**	**3.3**	*
Electric	115,347,626	111,557,374	110,165,384	3.4	1.3
Fuel	31,903,430	31,474,466	31,787,246	1.4	-1.0
Other Operating and Maintenance	51,752,113	47,454,042	44,904,829	9.1	5.7
Depreciation[1]	13,469,355	11,868,562	11,144,048	13.5	6.5
Taxes Other Than Income Taxes	10,319,912	9,744,870	9,371,961	5.9	4.0
Income Taxes	6,080,204	6,719,211	6,452,569	-9.5	4.1
Deferred Income Tax	2,078,160	3,737,781	5,573,126	-44.4	-32.9
Investment Tax Credit (Net)	-255,548	558,440	931,607	-145.8	-40.1
Gas	13,473,072	13,085,106	14,747,524	3.0	-11.3
Income Taxes	330,991	410,359	298,868	-19.3	37.3
Other	13,142,081	12,674,747	14,448,656	3.7	-12.3
Other Utility	909,659	917,909	692,750	-.9	32.5
Income Taxes	15,921	8,667	16,180	83.7	-46.4
Other	893,738	909,242	676,570	-1.7	34.4
Operating Income	**29,757,908**	**28,084,456**	**27,226,051**	**6.0**	**3.2**
Electric	28,582,794	26,991,564	26,091,974	5.9	3.4
Gas	1,107,873	1,028,614	1,080,040	7.7	-4.8
Other	67,240	64,278	54,037	4.6	19.0
Other Income and Deductions	**2,039,670**	**5,517,703**	**6,976,716**	**-63.0**	**-20.9**
Allowance for Other Funds Used During Construction	1,615,721	3,076,304	4,072,099	-47.5	-24.5
Taxes	-1,070,681	-1,230,042	-1,121,250	13.0	-9.7
Deferred Earnings (Misc.) (acct 421)	1,898,737	1,638,492	1,403,622	15.9	16.7
Other Income and Expenses--Net	-404,107	2,032,949	2,622,245	-119.9	-22.5
Total Income Before Interest Charges	**31,797,578**	**33,602,159**	**34,202,767**	**-5.4**	**-1.8**
Net Interest Charges	**14,386,924**	**13,621,908**	**13,479,472**	**5.6**	**1.1**
Interest Expense	15,333,123	15,217,562	15,603,157	.8	-2.5
Allowance for Borrowed Funds Used During Construction	-1,261,283	-1,864,473	-2,335,543	32.4	20.2
Other Charges--Net	315,084	268,820	211,857	17.2	26.9
Net Income Before Extraordinary Charges	**17,410,653**	**19,980,251**	**20,723,295**	**-12.9**	**-3.6**
Extraordinary Items After Taxes (Net)	**-1,368,946**	**-955,520**	**-299,734**	**-43.3**	**-218.8**
Net Income	**16,041,707**	**19,024,731**	**20,423,561**	**-15.7**	**-6.8**
Preferred Stock Dividend Requirements	2,264,454	2,297,668	2,649,832	-1.4	-13.3
Earnings Available for Common	13,777,253	16,727,063	17,773,729	-17.6	-5.9
Common Dividends	13,517,681	12,953,664	12,601,016	4.4	2.8
Additions to Retained Earnings	-13,385	2,601,817	5,376,361	-100.5	-51.6
Average Shares of Common Stock Outstanding	5,400,881	5,334,851	5,187,463	1.2	2.8
Earnings Available Per Average Common Share (Dollars)	2.55	3.14	3.43	-18.6	-8.5

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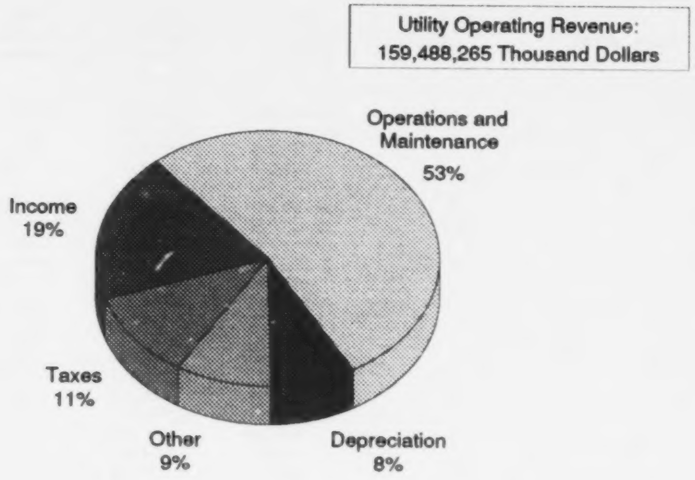
[1] Includes amortization and depletion.

* Value less than 0.5.

Notes: •Totals may not equal sum of components because of independent rounding. •Percent change is calculated before rounding.

Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Figure 19. The Revenue Dollar from Operations for Selected Private Electric Utilities, 1988



Note: Totals may not equal sum of components because of independent rounding.
Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Table 24. Composite Balance Sheet for Selected Private Electric Utilities, 1986-1988

Description	1988 (thousand dollars)	1987 (thousand dollars)	1986 (thousand dollars)	Percent Change	
				1988/1987	1987/1986
Assets					
Utility Plant - Net	**361,638,256**	**356,982,995**	**348,209,333**	**1.3**	**2.5**
Electric Utility Plant - Net	335,866,884	331,357,356	325,597,292	1.4	1.8
Electric Utility Plant	409,092,233	383,532,411	344,133,244	6.7	11.4
Construction Work in Progress	40,298,296	51,029,217	75,334,698	-21.0	-32.3
Accumulated Depreciation	-113,523,644	-103,204,272	-93,870,650	-10.0	-9.9
Nuclear Fuel - Net	9,642,680	10,386,899	8,600,265	-7.2	20.8
Other Utility Plant - Net	16,128,691	15,238,740	14,011,776	5.8	8.8
Other Property and Investments	**15,200,683**	**15,561,593**	**13,462,980**	**-2.3**	**15.6**
Current and Accrued Assets	**39,122,286**	**40,857,341**	**38,361,365**	**-4.2**	**6.5**
Deferred Debits	**38,335,664**	**32,868,949**	**26,067,995**	**16.6**	**26.1**
Total Assets	**454,296,889**	**446,270,877**	**426,101,673**	**1.8**	**4.7**
Capitalization and Liabilities					
Capitalization	**329,813,736**	**328,114,562**	**324,634,559**	**.5**	**1.1**
Common Stock Equity (End of Year)	142,715,825	142,931,813	139,050,743	-.2	2.8
Common Stock	93,158,701	92,284,680	90,703,933	.9	1.7
Retained Earnings (Adjusted)	49,557,124	50,647,133	48,346,810	-2.2	4.8
Preferred Stock	26,371,225	26,761,357	28,370,110	-1.5	-5.7
Long-term Debt	160,726,686	158,421,392	157,213,706	1.5	.8
Current and Other Liabilities	**124,483,152**	**118,156,315**	**101,467,115**	**5.4**	**16.4**
Other Noncurrent Liabilities	7,711,888	7,289,977	5,478,540	5.8	33.1
Current and Accrued Liabilities	38,412,073	39,344,892	34,001,972	-2.4	15.7
Deferred Credits	78,359,191	71,521,446	61,986,603	9.6	15.4
Accumulated Deferred Income Taxes	50,247,264	45,917,405	39,613,203	9.4	15.9
Accumulated Deferred Investment Tax Credit	16,792,695	17,275,481	16,993,188	-2.8	1.7
Other Deferred Credits (Adjusted)	11,319,232	8,328,561	5,380,212	35.9	54.8
Total Capitalization and Liabilities	**454,296,889**	**446,270,877**	**426,101,673**	**1.8**	**4.7**

Notes: •Totals may not equal sum of components because of independent rounding. •Percent change is calculated before rounding.
Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Table 25. Composite Financial Indicators for Selected Private Electric Utilities, 1986-1988

Description[1]	1988	1987	1986
Activity			
1. Electric Fixed Asset (Net Plant) Turnover	0.43	0.42	0.42
2. Total Asset Turnover	.35	.34	.36
Leverage			
3. Current Assets to Current Liabilities	1.02	1.04	1.13
4. Long-term Debt to Capitalization	48.73	48.28	48.43
5. Preferred Stock to Capitalization	8.00	8.16	8.74
6. Common Stock Equity to Capitalization	43.27	43.56	42.83
7. Total Debt to Total Assets[2]	36.67	37.18	38.06
8. Common Stock Equity to Total Assets	31.42	32.03	32.63
9. Interest Coverage Before Taxes without AFUDC[3]	2.35	2.42	2.29
Profitability			
10. Profit Margin	10.06	12.38	13.36
11. Return on Average Common Stock Equity[4]	11.23	13.49	15.10
12. Return on Investment	3.53	4.26	4.79

[1] Indicators 1, 2, 3, and 9 are ratios. Indicators 4 through 8 and 10 through 12 are percentages.

[2] Total debt is the sum of Long-term Debt and Short-term Debt. The values for Short-term Debt are included in Current and Accrued Liabilities (Notes Payable) were $5,843,202 for 1988, $7,500,551 for 1987, and $4,979,358 for 1986.

[3] Taxes other than income taxes (included in Other Income and Expenses-Net) should be added to Taxes from Other Income and Deductions. The values were $552,805 for 1988, $399 495 for 1987, and -$59,184 for 1986.

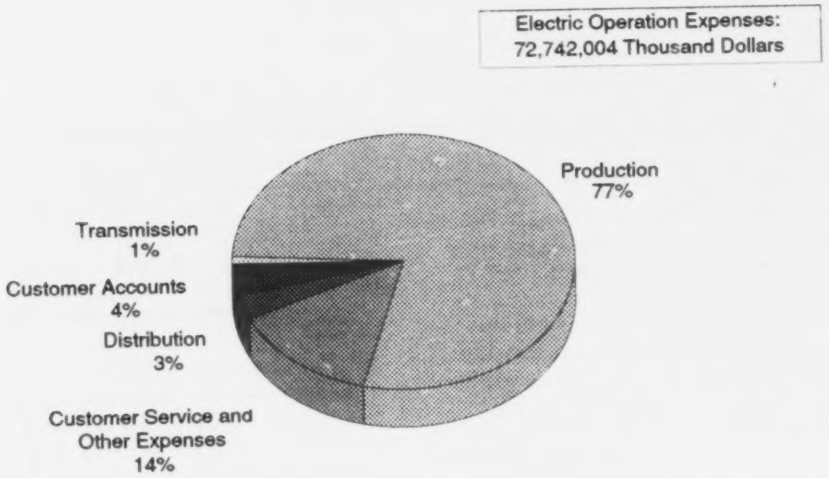
[4] The Average Common Stock Equity is the average of the beginning and ending year balances. The values for the beginning of each year were $142,931,813 for 1988, $139,050,743 for 1987, and$131,460,613 for 1986.

AFUDC = Allowance for Funds Used During Construction.

Notes: •Formulas for computing the financial indicators are in Appendix D. •Indicators 4, 5, and 6 may not sum to 100 percent because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Figure 20. Share of Electric Operating Expenses for Selected Private Electric Utilities, 1988



Note: Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Table 26. Revenue and Expense Statistics for Selected Private Electric Utilities, 1986-1988

Description	1988 (thousand dollars)	1987 (thousand dollars)	1986 (thousand dollars)	Percent Change	
				1988/1987	1987/1986
Utility Operating Revenue	**159,488,265**	**153,644,845**	**152,831,710**	**3.8**	**0.5**
Electric Utility	143,930,420	138,548,938	136,257,358	3.9	1.7
Other Utility	15,557,844	15,095,907	16,574,352	3.1	-8.9
Electric Operating Expenses	**129,730,357**	**125,560,389**	**125,605,659**	**3.3**	*
Electric Utility	115,347,626	111,557,374	110,165,384	3.4	1.3
Operation	72,742,004	68,616,305	66,987,757	6.0	2.4
Production	56,186,332	52,889,982	51,977,614	6.2	1.8
Cost of Fuel	31 903,430	31,474,466	31,787,246	1.4	-1.0
Purchased Power	16,061,339	14,719,739	13,640,925	9.1	7.9
Other	8,221,563	6,695,777	6,549,443	22.8	2.2
Transmission	1,026,861	983,285	936,010	4.4	5.1
Distribution	2,331,160	2,232,547	2,160,590	4.4	3.3
Customer Accounts	2,894,179	2,826,170	2,715,683	2.4	4.1
Customer Service	887,963	850,576	822,428	4.4	3.4
Sales	177,006	142,154	93,223	24.5	52.5
Administrative and General	9,238,502	8,691,593	8,282,207	6.3	4.9
Maintenance	10,913,539	10,312,203	9,704,318	5.8	6.3
Depreciation	13,469,355	11,868,562	11,144,048	13.5	6.5
Taxes	18,222,728	20,760,304	22,329,261	-12.2	-7.0
Other Utility	14,382,731	14,003,015	15,440,274	2.7	-9.3
Income From Utility Operations	**29,757,908**	**28,084,456**	**27,226,051**	**6.0**	**3.2**

* Less than the absolute value of 0.1.

Notes: •Totals may not equal sum of components because of independent rounding. •Percent change is calculated before rounding.

Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Table 27. Revenue and Expense Percentages for Selected Private Electric Utilities, 1986-1988

Description	1988	1987	1986
Utility Operating Revenue	**100.0**	**100.0**	**100.0**
Electric Utility	90.2	90.2	89.2
Other Utility	9.8	9.8	10.8
Electric Operating Expenses	**81.3**	**81.7**	**82.2**
Electric Utility	72.3	72.6	72.1
Operation	45.6	44.7	43.8
Production	35.2	34.4	34.0
Cost of Fuel	20.0	20.5	20.8
Purchased Power	10.1	9.6	8.9
Other	5.2	4.4	4.3
Transmission	.6	.6	.6
Distribution	1.5	1.5	1.4
Customer Accounts	1.8	1.8	1.8
Customer Service	.6	.6	.5
Sales	.1	.1	.1
Administrative and General	5.8	5.7	5.4
Maintenance	6.8	6.7	6.3
Depreciation	8.4	7.7	7.3
Taxes	11.4	13.5	14.6
Other Utility	9.0	9.1	10.1
Income From Utility Operations	**18.7**	**18.3**	**17.8**

Note: Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Environmental Statistics

When fossil fuels are burned in the production of electricity, a variety of gases and particulates are formed. If these gases and particulates are not captured by some pollution control equipment, they are released into the atmosphere. This chapter provides a brief summary of these gaseous emissions and the methods employed to reduce or eliminate their release into the atmosphere.

Background

Among the gases emitted during the burning of fossil fuels are sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2). Coal-fired generating units produce more sulfur dioxide and nitrogen oxides than other fossil fuel units for two reasons. First, coal generally contains more sulfur than other fossil fuels and creates more nitrogen oxides when burned. Second, more coal-fired generating capacity exists than any other type.

Sulfur is an element that is present in almost all coal, although some kinds of coal contain more sulfur than others. During combustion, the sulfur combines with the oxygen in the air to form *sulfur dioxide*. As the sulfur dioxide mixes further with oxygen and trace substances in the air, a variety of sulfate compounds emerges. How these transformations take place, and in what proportions, is a subject of vigorous research. The behavior of sulfur emissions depends partly on the type of coal used and how it is burned. In addition, the presence of light, moisture, and other pollutants in the atmosphere may also be important in triggering the complex changes that sulfur emissions undergo.

Nitrogen is a colorless, odorless gas that makes up about 78 percent of the atmosphere. Nitrogen combines with oxygen and water to form several *nitrogen oxides*. The most important is nitrogen dioxide, one of the compounds that gives photochemical smog its characteristic yellowish-brown color. Only about 10 percent of the nitrogen compounds in the air are the result of human activity. The rest are formed by natural processes, such as the decay of organic matter. However, since the human-made 10 percent is emitted mostly in industrial urban areas, concentration there can become high enough to cause concern.

Sulfur dioxide and nitrogen oxides are referred to as precursors to acid deposition, because, under the right set of conditions, they react with other chemicals in the atmosphere to form sulfuric acid and nitric acid, respectively. These two acids do not accumulate in the atmosphere, but are absorbed by rain droplets, thus cleansing the atmosphere and discharging acid onto the earth in the form of "acid rain." In addition, sulfuric acid may form microscopic droplets that can be deposited directly onto the ground. This form of deposition, as well as the direct capture of sulfur dioxide by vegetation, is referred to as dry deposition.

Carbon dioxide is a colorless, odorless, nontoxic gas formed by the combustion of carbon and carbon compounds found in coal, petroleum, and natural gas. There is no cost-effective way to limit the emission of carbon dioxide when burning fossil fuels. Tail gas cleanup (carbon dioxide scrubbing) is the only technological option. This option would require the adaptation of acid gas removal technologies used by the petroleum and petrochemical industries to the electric utility industry. Hence, there are no emission standards or required reductions. However, the Department of Energy is developing clean coal technologies such as pressurized fluidized bed combustion for new plants and repowering applications. Due to the increased conversion efficiencies of these technologies, carbon dioxide emissions are reduced. For each 5 percentage point improvement in conversion efficiency, carbon dioxide emissions are reduced by 10 to 15 percent. Carbon dioxide is normally removed from the atmosphere by green plants. The increased use of fossil fuels in recent years, as well as extensive deforestation, has caused a buildup of carbon dioxide in the atmosphere. This increase of carbon dioxide causes the atmosphere to absorb infrared radiation emitted from the earth that would otherwise have been dissipated into space. This phenomenon increases temperature and is called the "greenhouse" effect because it is similar to the trapping of the energy of the sun in a greenhouse. These increasing temperatures are of potential concern because they could cause dramatic climatic changes, shifts in agricultural zones, and partial melting of the polar ice caps resulting in flooding of coastal areas. However, significant uncertainties exist regarding global warming, and no conclusions can be drawn regarding future warming based on past temperature records. Efforts are underway to determine what methods can be employed to reduce or eliminate the release of carbon dioxide from power plants.

Emission Standards

To respond to concerns about emissions of sulfur dioxide and nitrogen oxides as well as several other air pollutants, Congress passed the Clean Air Act (CAA) in 1963. It was not until 1970, however, that the Environmental Protection Agency was empowered to set enforceable air quality standards. In 1971, this Agency established New Source Performance Standards (NSPS) that required coal-fired utility boilers built after August 17, 1971, to emit no more than 1.2 pounds of sulfur dioxide per million Btu of heat input. Requirements for nitrogen oxides were more complex, with allowable limits ranging from 0.2 pounds per million Btu to 0.8 pounds per million Btu, depending on the type of fuel burned and the combustion device used.

In 1977, Congress amended the CAA to require States to set limits on existing sources in regions not attaining goals established in the previous Act. In 1979, the Environmental Protection Agency established the Revised New Source Performance Standards (RNSPS). The new standards retain the 1971 NSPS standard of 1.2 pounds of sulfur dioxide per million Btu of heat input, but require sulfur dioxide emissions from all new or modified (post 1978) boilers to be reduced by at least 90 percent unless 90-percent removal reduces emissions to less than 0.6 pounds per million Btu. If emissions fall below that level, reductions between 70 and 90 percent are permitted, depending on the sulfur content of the coal. RNSPS for nitrogen oxides are complex and, as with NSPS, set limits varying from 0.2 to 0.8 pounds per million Btu, depending on the type of fuel burned and combustion device used. RNSPS for nitrogen oxides differ from NSPS in the number of categories of combustion into which they are divided.

Currently, a number of bills are pending in Congress that would revise the Clean Air Act to restrict emissions of precursors to acid deposition. The forerunner is "The Clean Air Act Amendments of 1989," a bill proposed by President Bush. This bill requires a 10-million-ton reduction in sulfur dioxide emissions and a 5-million-ton reduction in nitrogen oxide emissions by the year 2001. The sulfur dioxide reduction is to be achieved in two phases. The first phase is a 5-million-ton reduction from 1980 levels to be achieved by 1996. The second phase is an additional 5-million-ton reduction by 2001. The provisions for nitrogen oxides in the bill would apply to coal-fired generating units after 2000. Some approaches for achieving these reductions are contained within the bill (including the trading of emission-reduction credits between utilities).

Emission Reductions

Sulfur Dioxide. Several methods are available to reduce the sulfur dioxide emitted when burning coal. One method is to change the type of fuel used. This can be accomplished by switching to a coal that has a low-sulfur content (normally mined in the Western United States) or by using less-polluting fuels, particularly natural gas. Another approach is to install equipment designed to remove sulfur dioxide from the gas (flue gas) released through the flues of the plant. Additional methods for reducing emissions of sulfur dioxide, which include converting boilers to the fluidized-bed combustion process and employing the technology of integrated-gasification combined cycle, are currently under study and not in extensive use.

Nitrogen Oxides. Formation of nitrogen oxides is less dependent on the type of fuel burned than on how the fuel is burned. Apart from the nitrogen content of the fuel, the extent of nitric-oxide formation depends primarily on the combustion temperature. Nitrogen-oxide emissions can be reduced by low-excess-air firing; low-combustion temperatures; use of low-nitrogen fuels (such as natural gas and light distillate oil); staged combustion in which localized fuel-rich conditions are created where both thermal and fuel nitrogen oxides are minimized; and, use of low-nitrogen-oxide burners and fluidized-bed combustion.

Environmental Equipment

While not the only kind of environmental equipment installed at power plants, flue gas desulfurization units, particulate collectors, and cooling towers are the most significant. In a flue gas desulfurization (scrubber) unit, the gases resulting from combustion are passed through tanks containing a material that captures and neutralizes the sulfur dioxide. Particulate matter is most frequently removed from the combustion gases by either filtering (a series of filter bags that trap the ash and dust much like a household vacuum cleaner) in a baghouse or with an electrostatic precipitator. In the latter, the particulates are given an electric charge and collected. A cooling tower is a structure for transferring heat in the water to the atmosphere. The most common type of cooling tower is the wet tower, also called the evaporative tower. In a wet tower, cooling is caused mainly by evaporation of the water and partly by direct-heat transfer. For a fossil-fueled steam-electric generating unit, about two-thirds of the heat produced by burning the fuel is released to the environment, and only about one-third is used to produce electricity. Most waste heat (contained in the cooling water) is dissipated into a body of water, such as a river, lake, or bay. Cooling towers are installed where there is insufficient cooling water and where the waste heat discharged into the cooling water affects plants or marine life.[10]

Data Sources

Statistics are provided in the following tables on sulfur dioxide, nitrogen oxide, and carbon dioxide emissions from fossil-fueled steam-electric generating units. The methodology for computing emissions is described in Appendix D. Additional detailed information on emissions can be obtained in Chapter 4 and Appendix C of the *Annual Outlook for U. S. Electric Power 1989.*[11] Also presented in the following tables are the number and capacity of fossil-fueled steam-electric generators with environmental equipment (scrubbers, particulate collectors, and cooling towers). Because power plants can have more than one type of environmental equipment, the generators at these plants can be included in more than one category. Also, not all plants have environmental equipment. These data were either derived or obtained directly from the Form EIA-767, "Steam-Electric Plant Operation and Design Report." This form is used to collect boiler-specific data from over 900 power plants operated by approximately 320 electric utilities with a fossil-fueled steam-electric nameplate capacity of 10 or more megawatts in the United States. The entire form, including nameplate capacity and environmental equipment, is filed by 700 power plants with a nameplate capacity of 100 or more megawatts. Power plants with a nameplate capacity between 10 and 100 megawatts submit information only on fuel consumption and flue gas desulfurization equipment.

Table 28. Emissions from Fossil-Fueled Steam-Electric Generating Units, 1985-1988
(Thousand Tons)

Emission	1988	1987	1986	1985
Sulfur Dioxide (SO2)	16,588	16,121	16,361	16,114
Nitrogen Oxides (NOx)	6,917	6,636	6,415	6,530
Carbon Dioxide (CO2)	1,817,594	1,706,460	1,653,690	1,619,798

Source: Energy Information Administration, derived from Form EIA-767, "Steam-Electric Plant Operation and Design Report." (See Appendix D for methodology).

Table 29. Number and Capacity of Fossil-Fueled Steam-Electric Generators For Plants with Environmental Equipment, 1985-1988

Environmental Equipment	1988		1987		1986		1985	
	Number of Generators	Capacity[1] (megawatts)	Number of Generators	Capacity[1] (megawatts)	Number of Generators	Capacity[1] (megawatts)	Number of Generators	Capacity[1] (megawatts)
Scrubbers	153	67,570	151	66,646	151	64,865	142	59,256
Particulate Collectors	1,181	342,003	1,192	337,791	1,200	336,667	1,188	329,179
Cooling Towers	572	174,736	573	170,579	578	169,227	560	161,214
Total[2]	1,851	463,765	1,873	459,662	1,897	458,733	1,876	449,616

[1] Nameplate capacity.
[2] Components are not additive since some generators are included in more than one category and not all units have environmental equipment.
Note: These data are only for plants with a fossil-fueled steam-electric capacity of 100 or more megawatts.
Source: Energy Information Administration, Form EIA-767, "Steam-Electric Plant Operation and Design Report."

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[10] For a more detailed discussion of environmental equipment, see Energy Information Administration, *Annual Outlook for U.S. Electric Power* DOE/EIA-0474(85) (Washington, DC, August 1985).

[11] Energy Information Administration, *Annual Outlook for U. S. Electric Power* DOE/EIA-0474(89) (Washington, DC, June 1989).

Table 30. Emissions from Fossil-Fueled Steam-Electric Generating Units by Census Division and State, 1988 and 1987

(Thousand Tons)

Census Division State	1988			1987		
	Sulfur Dioxide	Nitrogen Oxides	Carbon Dioxide	Sulfur Dioxide	Nitrogen Oxides	Carbon Dioxide
New England	**427**	**141**	**51,605**	**385**	**130**	**46,248**
Connecticut	62	23	12,858	50	21	10,745
Maine	15	2	2,756	14	1	2,413
Massachusetts	263	87	29,039	249	83	27,308
New Hampshire	82	27	6,128	70	23	5,341
Rhode Island	5	2	822	2	2	428
Vermont	0	0	2	0	0	13
Middle Atlantic	**1,765**	**590**	**190,794**	**1,699**	**559**	**173,303**
New Jersey	86	62	13,382	90	61	11,962
New York	386	142	59,390	392	130	49,294
Pennsylvania	1,293	386	118,022	1,217	368	112,047
East North Central	**5,412**	**1,698**	**389,392**	**5,389**	**1,656**	**387,917**
Illinois	905	328	61,309	890	345	67,055
Indiana	1,497	443	94,771	1,494	393	90,295
Michigan	422	274	74,151	460	287	76,044
Ohio	2,285	509	121,834	2,248	501	117,964
Wisconsin	303	144	37,327	297	130	36,559
West North Central	**1,612**	**767**	**189,701**	**1,576**	**725**	**169,091**
Iowa	197	92	27,646	198	86	25,865
Kansas	108	72	22,106	94	69	21,234
Minnesota	150	100	31,420	100	127	25,541
Missouri	912	292	60,210	1,004	286	58,499
Nebraska	50	71	14,583	41	55	12,121
North Dakota	164	121	30,361	129	96	24,632
South Dakota	31	19	3,375	10	6	1,199
South Atlantic	**3,625**	**1,279**	**364,595**	**3,517**	**1,237**	**350,564**
Delaware	88	33	9,034	57	31	8,218
District of Columbia	3	1	517	2	0	297
Florida	729	305	82,620	682	291	75,603
Georgia	895	219	66,617	918	223	69,027
Maryland	277	91	27,314	255	85	24,459
North Carolina	320	158	46,903	311	151	45,504
South Carolina	173	80	24,328	178	79	23,917
Virginia	163	75	24,921	154	73	24,523
West Virginia	977	317	82,341	960	304	79,016
East South Central	**2,304**	**772**	**197,178**	**2,216**	**711**	**186,269**
Alabama	502	179	50,981	536	184	52,743
Kentucky	809	344	80,141	735	283	69,540
Mississippi	141	52	13,403	124	49	12,090
Tennessee	852	197	52,653	821	195	51,896
West South Central	**822**	**821**	**203,144**	**787**	**825**	**187,472**
Arkansas	72	76	22,697	67	75	22,002
Louisiana	90	119	21,515	72	108	17,653
Oklahoma	97	127	28,036	89	116	24,895
Texas	563	499	130,896	559	526	122,922
Mountain	**519**	**648**	**207,116**	**460**	**586**	**187,354**
Arizona	117	105	31,273	109	96	28,209
Colorado	112	102	31,230	96	97	29,607
Idaho	NA	NA	NA	NA	NA	NA
Montana	29	62	19,240	27	45	14,169
Nevada	67	65	20,939	59	54	17,411
New Mexico	65	83	29,057	62	82	28,722
Utah	39	86	30,410	33	75	26,451
Wyoming	90	145	44,967	74	137	42,785
Pacific Contiguous	**76**	**193**	**16,958**	**67**	**199**	**11,451**
California	14	151	7,000	3	158	1,913
Oregon	0	0	0	0	0	0
Washington	62	42	9,958	64	41	9,538
Pacific Noncontiguous	**26**	**8**	**7,111**	**25**	**8**	**6,791**
Alaska	1	0	474	1	0	507
Hawaii	25	8	6,637	24	8	6,284
U.S. Total	**16,588**	**6,917**	**1,817,594**	**16,121**	**6,636**	**1,706,460**

NA = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, derived from Form EIA-767, "Steam-Electric Plant Operation and Design Report." (See Appendix D for methodology).

Table 31. Emissions from Fossil-Fueled Steam-Electric Generating Units by Fossil Fuel, Census Division, and State, 1988

(Thousand Tons)

Census Division State	Coal			Petroleum			Gas		
	Sulfur Dioxide	Nitrogen Oxides	Carbon Dioxide	Sulfur Dioxide	Nitrogen Oxides	Carbon Dioxide	Sulfur Dioxide	Nitrogen Oxides	Carbon Dioxide
New England	**162**	**72**	**17,511**	**265**	**67**	**34,093**	**0**	**2**	**1**
Connecticut	10	6	2,518	52	17	10,340	0	0	0
Maine	0	0	0	15	2	2,756	0	0	0
Massachusetts	99	44	11,640	164	41	17,398	0	2	1
New Hampshire	53	22	3,353	29	5	2,775	0	0	0
Rhode Island	0	0	0	5	2	822	0	0	0
Vermont	0	0	0	0	0	2	0	0	0
Middle Atlantic	**1,586**	**476**	**144,033**	**179**	**79**	**46,750**	**0**	**35**	**11**
New Jersey	74	42	8,340	12	11	5,040	0	9	2
New York	231	59	24,251	155	57	35,130	0	26	9
Pennsylvania	1,281	375	111,442	12	11	6,580	0	0	0
East North Central	**5,398**	**1,690**	**385,911**	**14**	**6**	**3,460**	**0**	**2**	**1**
Illinois	900	326	59,966	5	1	1,343	0	1	0
Indiana	1,497	441	94,587	0	1	183	0	1	1
Michigan	415	271	72,650	7	3	1,501	0	0	0
Ohio	2,283	508	121,424	2	1	410	0	0	0
Wisconsin	303	144	37,284	0	0	43	0	0	0
West North Central	**1,609**	**764**	**189,209**	**3**	**0**	**491**	**0**	**3**	**1**
Iowa	197	91	27,610	0	0	36	0	1	0
Kansas	107	71	22,030	1	0	75	0	1	1
Minnesota	150	99	31,394	0	0	26	0	1	0
Missouri	910	292	59,951	2	0	259	0	0	0
Nebraska	50	71	14,529	0	0	54	0	0	0
North Dakota	164	121	30,337	0	0	24	0	0	0
South Dakota	31	19	3,358	0	0	17	0	0	0
South Atlantic	**3,406**	**1,179**	**332,352**	**219**	**68**	**32,235**	**0**	**32**	**8**
Delaware	71	22	6,563	17	9	2,471	0	2	0
District of Columbia	0	0	0	3	1	517	0	0	0
Florida	571	230	59,815	158	46	22,797	0	29	8
Georgia	893	219	66,450	2	0	167	0	0	0
Maryland	250	83	23,752	27	7	3,562	0	1	0
North Carolina	320	158	46,747	0	0	156	0	0	0
South Carolina	173	80	24,273	0	0	55	0	0	0
Virginia	151	71	22,596	12	4	2,325	0	0	0
West Virginia	977	316	82,156	0	1	185	0	0	0
East South Central	**2,293**	**763**	**196,228**	**11**	**2**	**948**	**0**	**7**	**2**
Alabama	502	179	50,884	0	0	97	0	0	0
Kentucky	809	344	80,040	0	0	101	0	0	0
Mississippi	130	43	12,741	11	2	660	0	7	2
Tennessee	852	197	52,563	0	0	90	0	0	0
West South Central	**819**	**537**	**201,940**	**3**	**3**	**1,118**	**0**	**281**	**86**
Arkansas	72	72	22,604	0	0	92	0	4	1
Louisiana	89	66	21,194	1	1	306	0	52	15
Oklahoma	97	87	28,000	0	0	27	0	40	9
Texas	561	312	130,142	2	2	693	0	185	61
Mountain	**517**	**640**	**206,272**	**2**	**1**	**841**	**0**	**7**	**3**
Arizona	117	103	31,158	0	0	114	0	2	1
Colorado	112	101	31,196	0	0	34	0	1	0
Idaho	NA	NA	NA	NA	NA	NA	NA	NA	NA
Montana	29	62	19,214	0	0	26	0	0	0
Nevada	65	62	20,434	2	1	504	0	2	1
New Mexico	65	81	29,007	0	0	49	0	2	1
Utah	39	86	30,359	0	0	51	0	0	0
Wyoming	90	145	44,904	0	0	63	0	0	0
Pacific Contiguous	**62**	**42**	**9,950**	**14**	**22**	**6,976**	**0**	**129**	**32**
California	0	0	0	14	22	6,968	0	129	32
Oregon	0	0	0	0	0	0	0	0	0
Washington	62	42	9,950	0	0	8	0	0	0
Pacific Noncontiguous	**1**	**0**	**474**	**25**	**8**	**6,637**	**0**	**0**	**0**
Alaska	1	0	474	0	0	0	0	0	0
Hawaii	0	0	0	25	8	6,637	0	0	0
U.S. Total	**15,853**	**6,163**	**1,683,880**	**735**	**256**	**133,569**	**0**	**498**	**145**

NA = Not applicable.
Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-767, "Steam-Electric Plant Operation and Design Report."

Table 32. Number and Capacity of Coal-Fired Steam-Electric Generators For Plants with Environmental Equipment by Census Division and State, 1988

Census Division State	Generating Units[1]		Scrubbers		Particulate Collectors		Cooling Towers	
	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)
New England	**15**	**3,138**	**0**	**0**	**14**	**3,065**	**0**	**0**
Connecticut	1	400	0	0	1	400	0	0
Maine	2	40	0	0	2	40	0	0
Massachusetts	10	2,240	0	0	9	2,166	0	0
New Hampshire	2	459	0	0	2	459	0	0
Rhode Island	0	0	0	0	0	0	0	0
Vermont	0	0	0	0	0	0	0	0
Middle Atlantic	**103**	**26,258**	**12**	**4,922**	**102**	**26,218**	**20**	**12,137**
New Jersey	9	1,909	0	0	9	1,909	3	476
New York	27	3,927	1	655	27	3,927	0	0
Pennsylvania	67	20,423	11	4,267	66	20,382	17	11,661
East North Central	**322**	**83,659**	**15**	**6,501**	**309**	**81,778**	**56**	**23,491**
Illinois	58	17,407	4	1,439	55	17,123	6	1,126
Indiana	72	21,780	9	4,174	71	21,743	21	8,462
Michigan	58	14,239	0	0	56	13,007	3	1,032
Ohio	92	22,867	2	888	85	22,539	23	11,976
Wisconsin	42	7,366	0	0	42	7,366	3	894
West North Central	**149**	**36,196**	**25**	**11,379**	**130**	**30,237**	**43**	**11,908**
Iowa	32	5,780	1	160	32	5,780	8	1,874
Kansas	23	4,318	7	3,072	18	4,154	9	2,957
Minnesota	27	5,509	7	3,339	25	5,459	10	4,033
Missouri	40	13,096	4	1,993	28	7,350	6	745
Nebraska	14	3,038	0	0	14	3,038	6	467
North Dakota	12	4,000	6	2,815	12	4,000	4	1,832
South Dakota	1	456	0	0	1	456	0	0
South Atlantic	**226**	**70,792**	**13**	**6,752**	**209**	**68,777**	**83**	**39,371**
Delaware	6	1,034	0	0	6	1,034	4	782
District of Columbia	0	0	0	0	0	0	0	0
Florida	39	11,133	7	3,883	28	10,675	15	7,148
Georgia	38	13,699	0	0	37	13,573	16	9,490
Maryland	17	5,990	0	0	15	4,672	5	2,731
North Carolina	40	12,101	0	0	38	12,039	10	4,256
South Carolina	25	5,374	4	1,501	24	5,324	10	2,846
Virginia	28	6,490	0	0	28	6,490	8	2,085
West Virginia	33	14,969	2	1,368	33	14,969	15	10,031
East South Central	**139**	**39,516**	**22**	**7,854**	**135**	**39,307**	**32**	**13,127**
Alabama	39	11,943	4	1,591	39	11,943	7	3,206
Kentucky	55	15,256	16	5,863	53	15,193	21	8,987
Mississippi	8	2,297	2	400	6	2,150	4	935
Tennessee	37	10,020	0	0	37	10,020	0	0
West South Central	**77**	**34,040**	**15**	**9,943**	**54**	**32,510**	**44**	**19,799**
Arkansas	7	4,038	0	0	5	3,958	4	3,400
Louisiana	9	3,869	1	721	6	3,572	6	3,261
Oklahoma	12	5,503	1	520	10	5,210	9	4,246
Texas	49	20,629	13	8,702	33	19,771	25	8,892
Mountain	**93**	**29,740**	**47**	**19,961**	**81**	**27,836**	**70**	**24,286**
Arizona	12	5,102	7	2,230	12	5,102	11	4,813
Colorado	28	4,913	4	1,594	24	4,898	17	3,278
Idaho	NA	NA	NA	NA	NA	NA	NA	NA
Montana	4	2,273	4	2,273	4	2,273	4	2,273
Nevada	8	2,769	5	879	8	2,769	7	1,951
New Mexico	14	4,392	10	4,282	6	2,503	5	2,012
Utah	12	4,757	7	3,970	12	4,757	12	4,757
Wyoming	15	5,534	10	[illegible],733	15	5,534	14	5,202
Pacific Contiguous	**9**	**2,229**	**0**	**0**	**3**	**1,890**	**4**	**1,399**
California	6	339	0	0	0	0	2	69
Oregon	1	561	0	0	1	561	0	0
Washington	2	1,330	0	0	2	1,330	2	1,330
Pacific Noncontiguous	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alaska	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0
U.S. Total	**1,133**	**325,569**	**149**	**67,310**	**1,037**	**311,617**	**352**	**145,518**

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[1] Components are not additive since some generators are included in more than one category and not all units have environmental equipment.

[2] Nameplate capacity.

NA = Not applicable.

Notes: •Totals may not equal sum of components because of independent rounding. •These data are only for plants with a fossil-fueled steam-electric capacity of 100 or more megawatts.

Source: Energy Information Administration, Form EIA-767, "Steam-Electric Plant Operation and Design Report."

Table 33. Number and Capacity of Petroleum- and Gas-Fired Steam-Electric Generators For Plants with Environmental Equipment by Census Division and State, 1988

Census Division State	Generating Units[1]		Scrubbers		Particulate Collectors		Cooling Towers	
	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)	Number of Generators	Capacity[2] (megawatts)
New England	**47**	**8,265**	**0**	**0**	**38**	**6,515**	**5**	**865**
Connecticut	17	2,803	0	0	16	2,389	4	837
Maine	7	953	0	0	7	953	0	0
Massachusetts	14	3,684	0	0	7	2,374	1	28
New Hampshire	5	589	0	0	4	564	0	0
Rhode Island	4	236	0	0	4	236	0	0
Vermont	0	0	0	0	0	0	0	0
Middle Atlantic	**90**	**20,629**	**0**	**0**	**45**	**10,012**	**6**	**1,962**
New Jersey	25	3,827	0	0	11	1,637	4	261
New York	58	14,383	0	0	29	7,657	0	0
Pennsylvania	7	2,419	0	0	5	718	2	1,701
East North Central	**35**	**5,151**	**0**	**0**	**3**	**154**	**6**	**273**
Illinois	19	3,504	0	0	0	0	5	230
Indiana	6	279	0	0	0	0	1	43
Michigan	5	1,252	0	0	3	154	0	0
Ohio	1	25	0	0	0	0	0	0
Wisconsin	4	91	0	0	0	0	0	0
West North Central	**21**	**1,721**	**0**	**0**	**1**	**147**	**12**	**1,359**
Iowa	1	147	0	0	1	147	0	0
Kansas	14	1,381	0	0	0	0	12	1,359
Minnesota	2	23	0	0	0	0	0	0
Missouri	3	61	0	0	0	0	0	0
Nebraska	1	109	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0	0	0
South Atlantic	**108**	**17,758**	**3**	**65**	**42**	**10,435**	**22**	**1,994**
Delaware	8	737	3	65	4	511	2	132
District of Columbia	2	580	0	0	0	0	2	580
Florida	71	14,582	0	0	21	8,608	12	859
Georgia	6	402	0	0	0	0	0	0
Maryland	10	861	0	0	10	861	1	162
North Carolina	7	455	0	0	7	455	4	210
South Carolina	4	142	0	0	0	0	1	50
Virginia	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0
East South Central	**13**	**3,112**	**0**	**0**	**1**	**147**	**3**	**200**
Alabama	0	0	0	0	0	0	0	0
Kentucky	1	147	0	0	1	147	0	0
Mississippi	12	2,965	0	0	0	0	3	200
Tennessee	0	0	0	0	0	0	0	0
West South Central	**240**	**55,426**	**0**	**0**	**4**	**2,258**	**96**	**15,400**
Arkansas	13	2,409	0	0	0	0	7	580
Louisiana	53	11,606	0	0	2	1,184	14	1,835
Oklahoma	23	5,866	0	0	1	567	17	3,339
Texas	151	35,546	0	0	1	507	58	9,646
Mountain	**42**	**3,412**	**1**	**195**	**3**	**296**	**33**	**2,520**
Arizona	21	1,792	1	195	1	195	18	1,402
Colorado	3	111	0	0	2	101	1	10
Idaho	NA	NA	NA	NA	NA	NA	NA	NA
Montana	0	0	0	0	0	0	0	0
Nevada	8	643	0	0	0	0	4	243
New Mexico	9	800	0	0	0	0	9	800
Utah	1	66	0	0	0	0	1	66
Wyoming	0	0	0	0	0	0	0	0
Pacific Contiguous	**108**	**21,636**	**0**	**0**	**7**	**422**	**37**	**4,644**
California	108	21,636	0	0	7	422	37	4,644
Oregon	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0
Pacific Noncontiguous	**14**	**1,086**	**0**	**0**	**0**	**0**	**0**	**0**
Alaska	0	0	0	0	0	0	0	0
Hawaii	14	1,086	0	0	0	0	0	0
U.S. Total	**718**	**138,197**	**4**	**260**	**144**	**30,386**	**220**	**29,217**

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[1] Components are not additive since some generators are included in more than one category and not all units have environmental equipment.

[2] Nameplate capacity.

NA = Not applicable.

Notes: •Totals may not equal sum of components because of independent rounding. •These data are only for plants with a fossil-fueled steam-electric capacity of 100 or more megawatts.

Source: Energy Information Administration, Form EIA-767, "Steam-Electric Plant Operation and Design Report."

Electric Power Transactions

This chapter provides summary information for the electric utility industry on its operations and wholesale electricity trade at the international (Canada and Mexico), national, and North American Electric Reliability Council (NERC) region levels. The NERC is an organization established by the electric utility industry for maintaining, coordinating, and promoting reliability among the interconnected systems of North America.

Background

An electric power system is a group of generation, transmission, distribution, communication, and other facilities that are physically connected and operated as a single unit under one control (Figure 21). Transmission and distribution lines and associated facilities are used to transmit electricity from its point of origin (the generator) to the ultimate consumer. Although, due to its physical characteristics, electricity flows along all available paths, it follows the path of least resistance. The flow of electricity must be closely monitored to ensure that a sufficient quantity is available to satisfy all demand (load) for electricity placed on the power system. In addition, the flow must be maintained at a frequency of 60 hertz per second.

The flow of electricity within the system is maintained and monitored by central dispatch centers. The dispatch center must inventory and prioritize all generating capacity available to it, track transactions involving the buying or selling of either electric power or capacity, monitor current load, and anticipate future load on the system. It is the responsibility of the dispatch center to match the supply of electricity with the demand for it. The demand for electricity is not constant in nature. That is, load requirements fluctuate continuously, based on such factors as time of day, season of the year, and the characteristics of territory served by the system. Nonetheless, the dispatch center must be ready to meet the highest level of load placed on the system. The dispatch center must accommodate the loss of generating facilities (both when planned and when unexpected). In addition, the center must monitor transmission lines to determine whether the flow of electricity is approaching the carrying limits of the lines. In order to carry out its responsibilities in a timely fashion, the dispatch center is authorized to buy and sell electricity based on system requirements.

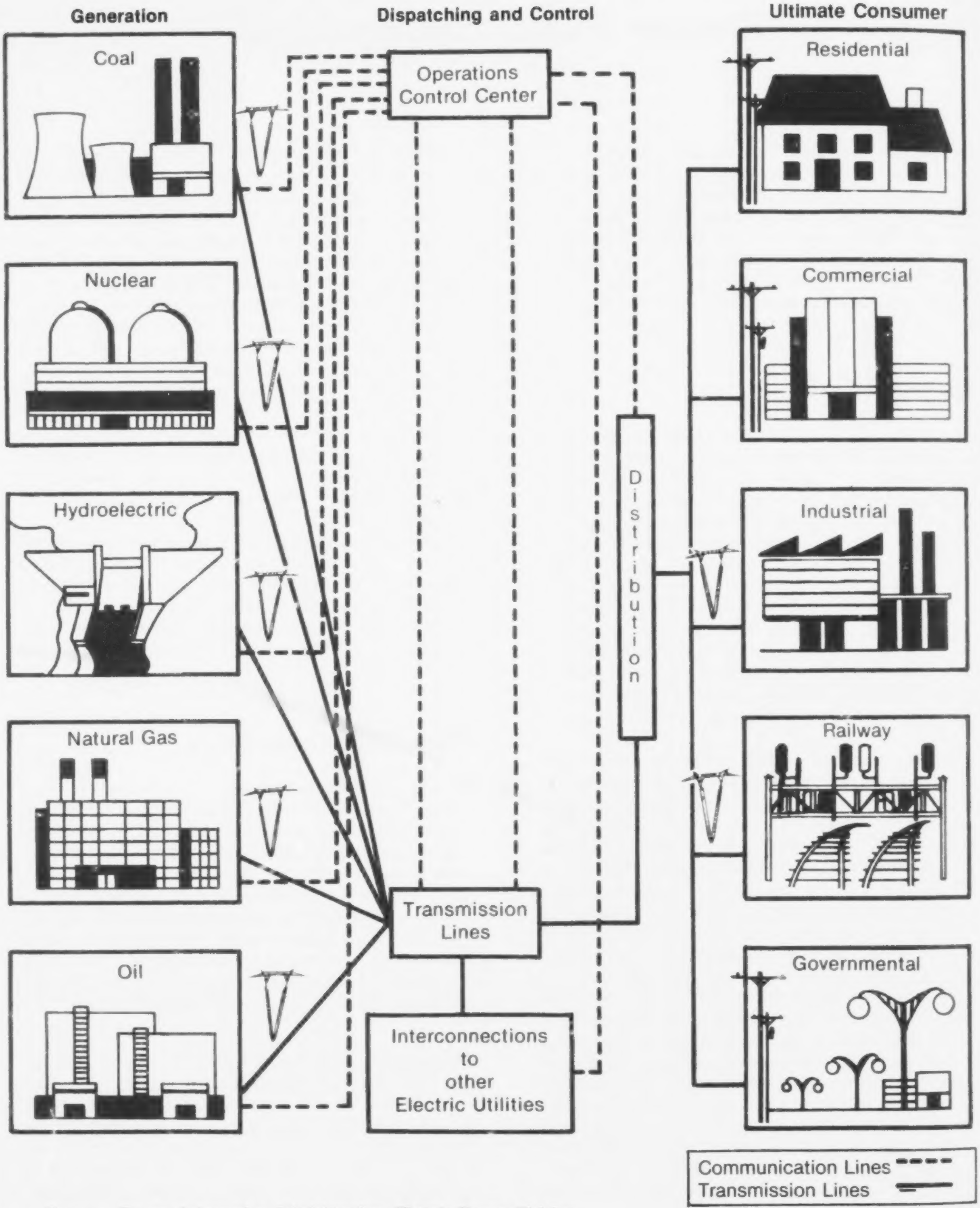
Authority for these transactions has been preapproved under interconnection agreements (contracts) that have been signed by all the electric utilities that are physically interconnected. These transactions include purchases, sales for resale, exchanges, and wheeling of energy. Purchase transactions involve buying power among electric utilities and nonutility producers of electricity. Sales for resale transactions refer to power sold by one electric utility to other utilities for distribution. Some transactions involving the trade of electric energy are based on the availability of excess generating capacity or the diversity in load requirements. For example, if one electric utility has its lowest load during the winter season, it may arrange to offer its available excess generating capacity in exchange for excess generating capacity available at a facility with low summer load. This type of arrangement is an exchange transaction. However, the repayment or replacement of exchange energy may extend over several years. Wheeling transactions are the movement of electricity from one utility to another utility over the transmission facilities of the intervening utility. Electric energy is lost within wheeling transactions. These transmission losses are accepted as a part of transmission services.

Power Pool Transactions

In addition to dealing in one-time purchase and sale transactions, many electric utilities have joined together and formed power pools to achieve better operating efficiencies and to gain additional support for maintaining a functional electrical system. Thus, they share the benefits achieved by joint planning, coordinated use of generating and transmission facilities, and/or coverage of facility outages. This coordination also provides the opportunity to manage short-term saving, much of it coming from varying fuel prices and the costs associated with different mixes of capacity.

Power pools can be made up of two electric utilities, like the Michigan Electric Coordinated System (Detroit Edison Company and Consumer Power Company), include all the major privately owned utilities within a State (the New York Power Pool), or cross State lines (the PJM Power Pool includes parts or all of Pennsylvania, New Jersey, Maryland, and Delaware).

Figure 21. An Integrated Electric Utility System


Generation
Dispatching and Control
Ultimate Consumer
Coal
Nuclear
Hydroelectric
Natural Gas
Oil
Operations Control Center
Transmission Lines
Interconnections to other Electric Utilities
Distribution
Residential
Commercial
Industrial
Railway
Governmental
Communication Lines
Transmission Lines

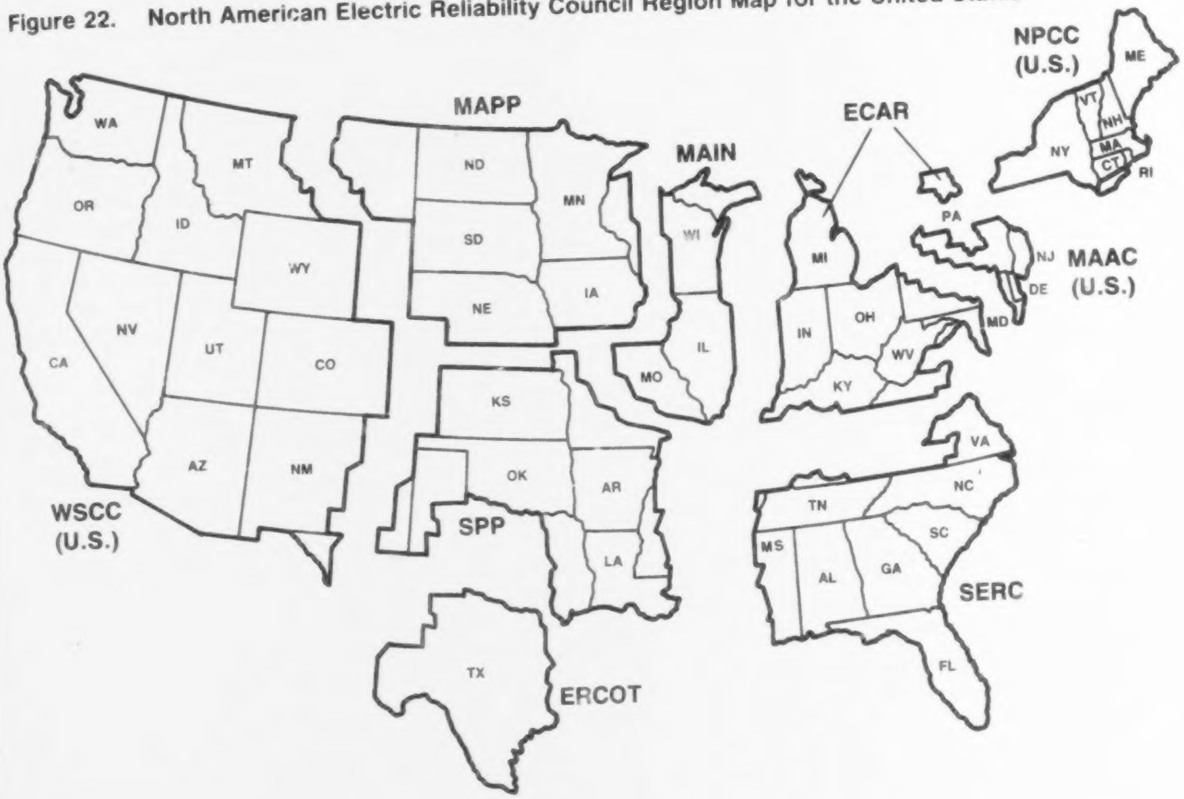
Source: Energy Information Administration, Electric Power Division.

Power pools may run under a single-system dispatch to meet combined load requirements and maintenance programs, or just share the benefits of planned or hourly wholesale sales of power and energy among the member utilities. These power pools may have responsibility for coordinating flow within the geographic area of the interconnected system. If not, they are bound by the operating standards established by the electric power industry. These standards require the coordination and maintenance of system stability and reliable service on a regional basis.

NERC Profile

The North American Electric Reliability Council (NERC) was formed in 1968 during the aftermath of the Northeast Blackout on November 9, 1965, and became incorporated in 1975 (Figure 22). The NERC consists of nine regional reliability councils whose memberships comprise essentially all of the electric utility systems in the contiguous United States, Canada, and Baja California Norte, Mexico. The NERC also has one affiliate member, the Alaska Systems Coordinating Council. The members of the regional councils are individual electric utilities from all ownership segments of the industry (privately owned and federally owned electric utilities; State and municipal utilities; and, rural electric cooperatives). The regional councils are responsible for maintaining the three power grids (the Seven Interconnected Regions Power Grid or the Eastern Power Grid, the Western Power Grid, and the Electric Reliability Council of Texas Power Grid) present in the contiguous United States. The data for NERC regions in this publication are for the U.S. portion of the regions only.

Figure 22. North American Electric Reliability Council Region Map for the United States



Regional Electric Reliabiity Council Areas:

ECAR—East Central Area Reliability Coordination Agreement

MAIN—Mid-American Interpool Network

MAAC—Mid-Atlantic Area Council

MAPP (U.S.)—Mid-Continent Area Power Pool

NPCC (U.S.)—Northeast Power Coordinating Council

SERC—Southeastern Electric Reliability Council

SPP—Southwest Power Pool

ERCOT—Electric Reliabiity Council of Texas

WSCC (U.S.)—Western Systems Coordinating Council

Source: North American Electric Reliabiity Council

Interutility Transactions

Interutility transactions *(wholesale electricity trade)* include purchases, sales for resale, interchanges, and the transmission of electricity. These transactions allow electric utilities to share resources and to provide mutual assistance in time of potential and actual need. They allow the utility systems to provide lower cost service to their customers by taking advantage of the load diversity of each utility. These transactions also allow each utility to conserve its own resources, to share the benefits of reduced operating costs with its consumers, to receive emergency energy support from other utilities, and to reduce the cost of its own requirements for operating reserve. However, due to the complexity of electric power transactions involving the specifics of contracts, simultaneous energy transactions, the unintended receipt and delivery of energy (inadvertent flow), and losses, the reporting of both the classification and quantity of each transaction among utilities may not be consistent.

Electric utilities originally became interested in energy transactions because of the savings gained from reduced or avoided production costs. It is advantageous to avoid building expensive additional capacity if the electricity can be obtained from other sources. Purchasing power from other utilities can help a utility meet peak load without using its expensive oil- or gas-fired turbines. Similarly, a utility benefits from being able to delay or stagger construction of additional baseload plants. Electric utilities are also delaying new plant construction by purchasing electricity from nonutility generators under long-term contracts.

Regulation of Interutility Transactions

The Federal Energy Regulatory Commission (FERC) is responsible for regulating wholesale transactions. Utilities file with the FERC for approval of proposed rate schedules for transmission services and charges, and for wholesale transactions. Transmission filings cover the allocation of electric power flows on the transmission line systems. These filings cover *firm-carrying* capacity, *interruptible-carrying* capacity, and *third-party-transfer* capacity. Other categories of filings usually cover the responsibilities of the utilities to one another during normal and emergency conditions, operating-reserves support, diversity exchanges, and unscheduled or inadvertent-energy flows.

Wholesale transactions include *capacity* sales, *energy* sales, and *energy exchanges*. Wholesale transactions are further divided by duration of the sale and the type of capacity and energy sold. The length of the sale can be for one hour, one day, one week, a month (or several months), a season, several years, or some combination of these time periods.

Capacity sales are usually considered *firm* sales (that is, associated energy may be taken, or the capacity must be paid for if the energy is not taken; and the delivery is scheduled during normal system operating conditions). This capacity may be made available from the entire system or from an identified generating unit. The capacity offered in these transactions may be available only during a set period of seasonal diversity, an off-peak time of the day, or from a generator, which is currently not fully utilized, that is fired by a particular fuel. The energy associated with this capacity sale, if required, has a separate cost schedule from the capacity charge attached to each kilowatt of power.

Nonfirm sales, sometimes called energy, economy, or interruptible, do not have a demand or capacity charge included in the price of the transaction. These transactions are subject to curtailment or cessation of delivery by the supplier in accordance with prior agreements or under specified conditions. The sales are often based on splitting the benefits gained by the parties involved. They are used to gain operational savings, such as avoiding the use of more expensive fuels, and selling electricity generated by the spillage of excess reservoir water.

Energy exchanges involve transfers of energy to other systems at no monetary charge. The energy must be returned in kind at a later date agreed upon by both parties, otherwise the receiving party pays for the energy received. The incidental miscellaneous transfer of energy and inadvertent flow are also handled in the same manner. In total, these wholesale transactions have become very important tools used by the U.S. electric utility industry to reduce costs and avoid expensive new capacity.

International Transactions

U.S. utilities have also taken advantage of being able to enter into international trade agreements to acquire energy from Canada and Mexico. These trade agreements between utilities cover a variety of transaction options. These options include purchasing nonfirm energy from relatively inexpensive renewable resources (hydroelectric from Canada and geothermal from Mexico); acquiring additional generating capability to support the requirements for supply at U.S. electric utilities; the holding of purchased electricity (as reservoir water) to be reacquired when needed by U.S. electric utilities; and sharing the benefits of coordinated operations planning for the systems. In some instances, consumers can be served more efficiently if they are connected to foreign transmission lines because they are geographically closer to those lines.

Data Sources

Statistics on electricity transactions among electric utilities and on international electricity trade (including the United States, Canada, and Mexico) are presented in the following tables. These data were obtained from the Form EIA-861, "The Annual Electric Utility Report"; the Form EIA-860, "Annual Electric Generator Report"; the Department of Energy, Office of the Assistant Secretary for International Affairs and Energy Emergencies, Form IE-411, "Coordinated Bulk Power Supply Program"; and the Economic Regulatory Administration Form ERA-781R, "Annual Report of International Electric Import/Export Data."

Table 34. Energy Account Balance of Electricity, 1986-1988
(Gigawatthours)

Item	1988	1987	1986
Source			
Net Generation	2,456,329	2,368,831	2,296,886
Purchases from Utilities	809,543	772,815	763,106
Purchases from Nonutilities	67,067	50,053	39,238
Net Exchange	33,395	43,332	37,823
Net Wheeling	2,190	1,622	2,212
Disposition			
Sales to Ultimate Consumers	2,578,062	2,457,272	2,368,753
Sales for Resale	569,762	566,732	574,418
Energy Furnished Without Charge	5,075	4,808	3,350
Energy Used by Utility Electric Department	14,218	11,322	11,319
Energy Losses[1]	201,407	192,303	181,425

[1] These values are not measured; however, they represent losses and unaccounted for energy. These values are calculated in order that source and disposition of energy are equivalent.

Notes: •Annual net generation data shown here should only be used in comparison with other Form EIA-861 data. Total annual net generation data are published by the Energy Information Administration from its Form EIA-759, "Monthly Power Plant Report," (Table 1). •Totals may not equal sum of components because of independent rounding. •Source and disposition are the aggregation of data reported for each utility. Source and disposition of energy are not additive due to double counting. Purchases from utilities, net exchange and net wheeling (except for imports) are included in net generation. Sales for resale is included in sales to ultimate consumers. •Due to the complexity of electric power transactions that involve specifics of contracts, simultaneous energy transactions, the unintended receipt and delivery of energy (inadvertent flow), and losses, uniformity in reporting the classification and quantity of each transaction among utilities may not exist.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 35. Net Generation by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988
(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	1988	1987	1986
ECAR	429,026	407,860	383,476
ERCOT	178,837	171,603	170,963
MAAC	188,638	181,987	176,587
MAIN	195,944	178,948	174,204
MAPP(U.S.)	95,060	92,714	82,560
NPCC(U.S.)	200,811	191,962	184,485
SERC	505,113	490,779	477,623
SPP	204,563	205,649	203,008
WSCC(U.S.)	446,767	436,180	433,153
Contiguous U.S.	**2,444,757**	**2,357,683**	**2,286,059**
Alaska	4,188	4,153	4,152
Hawaii	7,384	6,995	6,675
U.S. Total	**2,456,329**	**2,368,831**	**2,296,886**

Notes: •Annual net generation data shown here should only be used in comparison with other Form EIA-861 data. Total annual net generation data are published by the Energy Information Administration from its Form EIA-759, "Monthly Power Plant Report," (Table 1). •Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 36. Sales of Electricity to Ultimate Consumers by Sector, North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988

(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	Residential	Commercial	Industrial	Other[1]	Total
			1988		
ECAR	128,073	89,404	181,082	9,611	408,171
ERCOT	69,954	53,121	67,880	5,663	196,617
MAAC	69,794	60,669	69,511	2,730	202,705
MAIN	58,202	51,470	67,344	8,414	185,430
MAPP(U.S.)	42,616	23,479	43,596	3,445	113,136
NPCC(U.S.)	74,897	83,030	57,527	13,429	228,883
SERC	217,201	135,410	176,737	15,901	545,250
SPP	76,942	56,183	76,625	8,530	218,281
WSCC(U.S.)	151,552	142,624	152,277	21,683	468,136
Contiguous U.S.	**889,231**	**695,390**	**892,579**	**89,407**	**2,566,607**
Alaska	1,590	1,778	542	135	4,045
Hawaii	2,045	1,932	3,378	56	7,411
U.S. Total	**892,866**	**699,100**	**896,498**	**89,598**	**2,578,062**
			1987		
ECAR	121,657	83,615	175,264	9,264	389,799
ERCOT	66,815	50,573	65,752	5,346	188,487
MAAC	65,279	56,758	66,946	2,694	191,677
MAIN	54,992	48,813	54,889	8,108	176,801
MAPP(U.S.)	39,632	22,106	39,739	3,210	104,687
NPCC(U.S.)	70,366	78,376	55,330	12,898	216,979
SERC	210,117	128,363	169,068	15,352	522,900
SPP	75,212	53,554	74,363	8,677	211,806
WSCC(U.S.)	142,826	134,737	143,168	22,435	443,165
Contiguous U.S.	**846,897**	**656,894**	**854,527**	**87,983**	**2,446,302**
Alaska	1,540	1,729	516	157	3,943
Hawaii	1,973	1,810	3,189	56	7,028
U.S. Total	**850,410**	**660,433**	**858,233**	**88,196**	**2,457,272**
			1986		
ECAR	116,506	80,153	167,012	9,137	372,808
ERCOT	65,003	49,325	66,077	5,408	185,812
MAAC	61,271	53,643	65,089	2,716	182,720
MAIN	53,265	46,084	64,668	7,722	171,739
MAPP(U.S.)	40,695	22,121	38,494	3,283	104,593
NPCC(U.S.)	66,648	74,035	54,222	12,761	207,666
SERC	199,555	120,828	162,625	14,905	497,914
SPP	73,750	52,257	73,145	9,085	208,238
WSCC(U.S.)	138,908	128,594	135,584	23,368	426,455
Contiguous U.S.	**815,603**	**627,040**	**826,916**	**88,385**	**2,357,944**
Alaska	1,616	1,776	463	174	4,029
Hawaii	1,869	1,704	3,152	55	6,780
U.S. Total	**819,088**	**630,520**	**830,531**	**88,615**	**2,368,753**

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[1] Includes public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 37. Generating Capability by North American Electric Reliability Council Region, Alaska, and Hawaii, as of December 1986-1988

(Megawatts)

North American Electric Reliability Council Region, Alaska, and Hawaii	1988	1987	1986
ECAR	101,257	101,337	101,490
ERCOT	48,928	45,835	45,568
MAAC	48,766	48,744	48,773
MAIN	49,631	49,228	46,329
MAPP(U.S.)	30,348	32,718	32,028
NPCC(U.S.)	54,067	53,731	52,927
SERC	142,404	141,430	138,750
SPP	70,311	70,158	70,210
WSCC(U.S.)	128,986	126,112	125,891
Contiguous U.S.	**674,697**	**671,293**	**661,966**
Alaska	1,504	1,490	1,480
Hawaii	1,453	1,361	1,360
U.S. Total	**677,654**	**674,144**	**664,807**

Notes: •Totals may not equal sum of components because of independent rounding. •Generating capability is net summer capability.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 38. Noncoincident Peak Load by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988

(Megawatts)

North American Electric Reliabiltiy Council Region, Alaska, and Hawaii	1988		1987		1986	
	Summer	Winter	Summer	Winter	Summer	Winter
ECAR	79,149	67,771	72,561	68,118	69,606	64,561
ERCOT	40,843	34,621	39,339	31,399	39,335	26,730
MAAC	43,110	36,363	40,526	35,775	37,564	32,607
MAIN	41,139	30,631	37,446	30,606	35,943	28,036
MAPP(U.S.)	24,899	20,162	23,162	19,335	21,029	18,850
NPCC(U.S.)	45,245	42,951	42,651	41,902	39,026	37,976
SERC	115,168	108,649	109,798	105,476	105,570	101,849
SPP	49,356	35,649	47,723	34,472	47,123	33,877
WSCC(U.S.)	90,551	82,937	82,967	81,182	81,787	76,171
Contiguous U.S.	**529,460**	**459,734**	**496,173**	**448,265**	**476,983**	**422,857**
Alaska						
Hawaii						
U.S. Total	**529,460**	**459,734**	**496,173**	**448,265**	**476,983**	**422,857**

[1] Data for Alaska and Hawaii are not collected on this form.
Note: Noncoincident peak load is the sum of utility peak loads that may occur at the same time.
Source: Department of Energy, Office of the Assistant Secretary for International Affairs and Energy Emergencies, Form IE-411, "Coordinated Bulk Power Supply Program."

Table 39. Interutility Receipts by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988
(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	Purchased Power			Exchange Received			Wheeling Received			Total Receipts[1]		
	1988	1987	1986	1988	1987	1986	1988	1987	1986	1988	1987	1986
ECAR	81,444	75,519	78,355	75,326	65,616	89,198	13,597	8,904	14,621	170,366	150,039	182,175
ERCOT	52,867	50,598	46,737	27,768	27,491	8,539	158	32	2,334	80,793	78,121	57,610
MAAC	40,247	31,394	27,056	27,731	31,827	28,415	7,482	973	2,139	75,460	64,194	57,610
MAIN	22,118	21,694	20,088	27,027	26,332	23,932	1,915	2,071	571	51,061	50,097	44,591
MAPP(U.S.)	56,635	52,172	52,672	34,224	31,739	40,261	7,025	6,643	5,473	97,884	90,554	98,406
NPCC(U.S.)	113,280	112,529	116,138	14,738	16,093	13,271	25,090	13,069	12,352	153,109	141,692	141,761
SERC	218,754	209,226	187,518	77,949	83,968	74,848	9,119	10,715	9,179	305,822	303,909	271,545
SPP	88,742	78,503	78,741	7,370	16,876	26,301	20,089	9,951	8,479	116,201	105,331	113,521
WSCC(U.S.)	200,297	189,108	192,865	70,301	77,599	81,512	144,464	118,769	117,591	415,062	385,476	391,969
Contiguous U.S.	**874,384**	**820,744**	**800,170**	**362,434**	**377,541**	**386,277**	**228,940**	**171,127**	**172,740**	**1,465,758**	**1,369,413**	**1,359,187**
Alaska	1,734	1,653	1,659	28	27	21	226	246	270	1,989	1,926	1,950
Hawaii	492	471	515	5	11	14	0	0	0	497	481	529
U.S. Total	**876,610**	**822,868**	**802,344**	**362,468**	**377,579**	**386,312**	**229,166**	**171,373**	**173,010**	**1,468,244**	**1,371,820**	**1,361,666**

[1] Equals purchased power plus exchange received plus wheeling received.

Notes: •Totals may not equal sum of components because of independent rounding. •Summation of interutility trade for utilities that operate within the NERC Region. •Due to the complexity of electric power transactions that involve specifics of contracts, simultaneous energy transactions, the unintended receipt and delivery of energy (inadvertent flow), and losses, uniformity in reporting the classification and quantity of each transaction among utilities may not exist. •Includes interutility, import, export, and nonutility transactions. Hawaii includes nonutility transactions only.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 40. Interutility Deliveries by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988
(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	Sales for Resale			Exchange Delivered			Wheeling Delivered			Total Deliveries[1]		
	1988	1987	1986	1988	1987	1986	1988	1987	1986	1988	1987	1986
ECAR	88,183	70,902	75,270	58,468	58,608	74,479	13,516	8,844	14,562	160,167	138,354	164,312
ERCOT	21,356	19,988	18,551	28,044	28,044	8,858	82	43	2,334	49,483	48,075	29,743
MAAC	12,476	12,073	11,261	23,513	24,518	22,846	7,465	1,534	2,426	43,454	38,124	36,532
MAIN	11,420	11,050	10,515	33,334	24,661	22,417	1,906	2,017	561	46,659	37,727	33,494
MAPP(U.S.)	29,198	30,785	24,019	34,690	28,244	38,254	5,972	6,050	4,810	69,860	65,079	67,083
NPCC(U.S.)	64,955	70,611	72,078	16,320	14,030	16,003	24,957	12,718	12,238	106,233	97,360	100,319
SERC	158,434	164,245	150,462	56,665	59,409	57,168	8,508	9,642	7,927	223,607	233,296	215,556
SPP	53,928	53,199	53,829	9,905	18,043	28,163	19,956	9,818	8,408	83,789	81,060	90,400
WSCC(U.S.)	128,307	132,416	156,988	68,129	78,684	80,296	144,398	118,847	117,271	340,834	329,947	354,555
Contiguous U.S.	**568,256**	**565,268**	**572,973**	**329,069**	**334,241**	**348,483**	**226,761**	**169,514**	**170,537**	**1,124,086**	**1,069,022**	**1,091,993**
Alaska	1,506	1,464	1,446	0	1	1	215	237	260	1,721	1,702	1,707
Hawaii	0	0	0	4	4	5	0	0	0	4	4	5
U.S. Total	**569,762**	**566,732**	**574,418**	**329,073**	**334,246**	**348,489**	**226,976**	**169,751**	**170,798**	**1,125,810**	**1,070,729**	**1,093,705**

[1] Equals sales for resale plus exchange delivered plus wheeling delivered.

Notes: •Totals may not equal sum of components because of independent rounding. •Summation of interutility trade for utilities that operate within the NERC Region. •Due to the complexity of electric power transactions that involve specifics of contracts, simultaneous energy transactions, the unintended receipt and delivery of energy (inadvertent flow), and losses, uniformity in reporting the classification and quantity of each transaction among utilities may not exist. •Includes interutility, import, export, and nonutility transactions. Hawaii includes nonutility transactions only.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 41. Interutility Net Energy Flow by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988

(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	Receipts[1]			Deliveries[2]			Net Energy Flow[3]		
	1988	1987	1986	1988	1987	1986	1988	1987	1986
ECAR	170,366	150,039	182,175	160,167	138,354	164,312	10,199	11,685	17,863
ERCOT	80,793	78,121	57,610	49,483	48,075	29,743	31,310	30,045	27,868
MAAC	75,460	64,194	57,610	43,454	38,124	36,532	32,005	26,070	21,077
MAIN	51,061	50,097	44,591	46,659	37,727	33,494	4,402	12,370	11,097
MAPP(U.S.)	97,884	90,554	98,406	69,860	65,079	67,083	28,024	25,475	31,323
NPCC(U.S.)	153,109	141,692	141,761	106,233	97,360	100,319	46,876	44,332	41,442
SERC	305,822	303,909	271,545	223,607	233,296	215,556	82,215	70,613	55,989
SPP	116,201	105,331	113,521	83,789	81,060	90,400	32,412	24,271	23,121
WSCC(U.S.)	415,062	385,476	391,969	340,834	329,947	354,555	74,228	55,530	37,414
Contiguous U.S.	**1,465,758**	**1,369,413**	**1,359,187**	**1,124,086**	**1,069,022**	**1,091,993**	**341,672**	**300,390**	**267,195**
Alaska	1,989	1,926	1,950	1,721	1,702	1,707	268	224	243
Hawaii	497	481	529	4	4	5	493	477	524
U.S. Total	**1,468,244**	**1,371,820**	**1,361,666**	**1,125,810**	**1,070,729**	**1,093,705**	**342,433**	**301,091**	**267,961**

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[1] Equals purchased power plus exchange received plus wheeling received.

[2] Equals sales for resale plus exchange delivered plus wheeling delivered.

[3] Equals receipts minus deliveries.

Notes: •Totals may not equal sum of components because of independent rounding. •Summation of interutility trade for utilities that operate within the NERC Region. •Due to the complexity of electric power transactions that involve specifics of contracts, simultaneous energy transactions, the unintended receipt and delivery of energy (inadvertent flow), and losses, uniformity in reporting the classification and quantity of each transaction among utilities may not exist. •Includes interutility, import, export, and nonutility transactions. Hawaii includes nonutility transactions only.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 42. Utility Purchases of Nonutility Generated Electricity by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988

(Gigawatthours)

North American Electric Reliability Council Region, Alaska, and Hawaii	1988	1987	1986
ECAR	368	606	131
ERCOT	22,170	21,976	18,030
MAAC	2,549	871	1,002
MAIN	103	32	18
MAPP(U.S.)	99	76	65
NPCC(U.S.)	6,288	4,181	2,817
SERC	8,012	4,274	3,149
SPP	1,319	997	397
WSCC(U.S.)	25,939	16,787	12,958
Contiguous U.S.	**66,847**	**49,800**	**38,566**
Alaska	*	47	157
Hawaii	220	206	515
U.S. Total	**67,067**	**50,053**	**39,238**

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* Value less than 0.5 megawatthours.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Utility Report."

Table 43. Net Imports by North American Electric Reliability Council Region, Alaska, and Hawaii, 1986-1988

(Megawatthours)

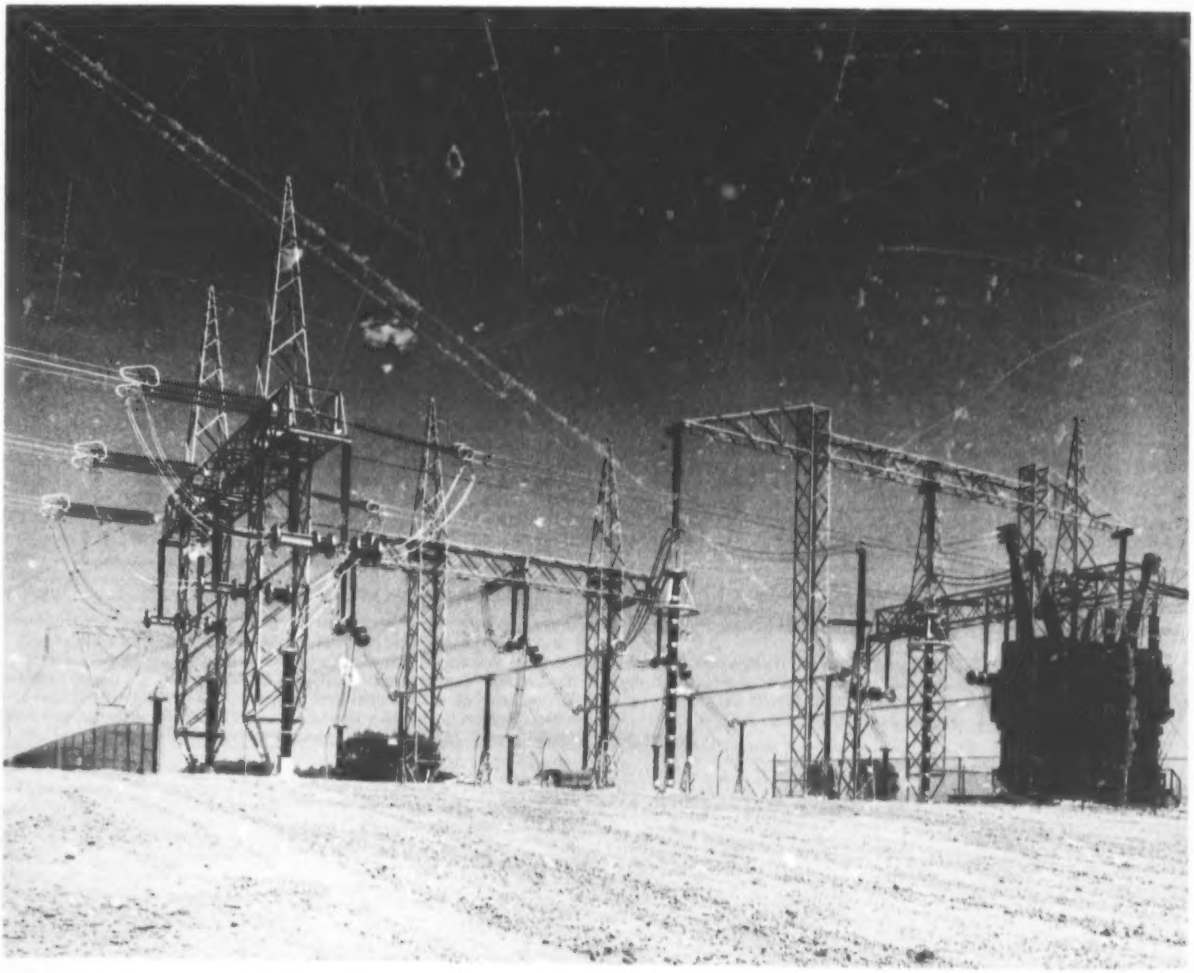
North American Electric Reliability Council Region, Alaska, and Hawaii	1988	1987	1986
ECAR	164,437	770,056	687,800
ERCOT	-11,762	-11,355	-10,497
MAAC	NA	NA	NA
MAIN	NA	NA	NA
MAPP(U.S.)	-1,279,546	3,325,019	7,837,389
NPCC(U.S.)	23,349,907	28,023,192	24,603,784
SERC	NA	NA	NA
SPP	NA	NA	NA
WSCC(U.S.)	9,436,828	14,230,947	2,778,622
Contiguous U.S.	**31,769,864**	**46,337,859**	**35,897,158**
Alaska	*	*	*
Hawaii	NA	NA	NA
U.S. Total	**31,769,864**	**46,337,859**	**35,897,158**

* Value less than 0.5.

NA = Not applicable.

Notes: •Totals may not equal sum of components because of independent rounding. •Values identify point of entry or exit, but do not necessarily identify point of consumption. •These data reflect electricity imported from Canada and Mexico. •Net imports data represent gross imports minus gross exports.

Source: Economic Regulatory Administration, Form ERA-781R, "Annual Report of International Electric Import/Export Data."



This transmission line, the most powerful in the Western World, is cosponsored by the American Electric Power System and Westinghouse Electric Corporation.

Appendix A

Operating Expenses for Generation of Electricity

Appendix A

Operating Expenses for Generation of Electricity

Operating expenses for the generation of electricity by major privately owned electric utilities are presented in this appendix (Table A1). Privately owned electric utilities dominate the industry accounting for about three-fourths of the generation in the United States. Privately owned utilities separate their costs into four functional areas: *generation transmission, distribution,* and *other.* Other costs generally include customer account expenses, customer service and informational expenses, sales expenses, administrative and general expenses, and the maintenance of general plants.

Operating expenses are comprised of operation (exclusive of fuel), maintenance, and fuel expenses. Operating expenses per unit of output (kilowatthours) for privately owned electric utilities are provided by the following categories: fossil-fueled steam, nuclear, hydroelectric, and other (includes gas-turbine, internal-combustion, geothermal, solar, and wind plants). Operation and maintenance expenses include recurring expenses to operate and maintain the physical condition or operating efficiency of the plant. These expenses include wages and benefits of the operators, plant maintenance, security, supervision, materials (such as spare parts), and supplies (except fuel consumed during plant operation and maintenance). The fuel expenses contained in the table include the cost of the fuel used to produce electricity as well as the costs of purchasing, handling, preparing, and transporting the fuel.

Table A1. Plant Operating Expenses for Major Privately Owned Electric Utilities, 1988 and 1987
(Mills per Kilowatthour)

Plant Type	Operation	Maintenance	Fuel	Total
		1987		
Nuclear	8.52	5.14	7.55	21.21
Fossil Steam[1]	1.93	2.85	18.73	23.52
Hydroelectric	3.33	2.57	NA	5.90
Other[2]	10.44	14.70	44.36	69.50
Average	**3.31**	**3.55**	**15.28**	**22.14**
		1988		
Nuclear	9.48	5.15	7.86	22.49
Fossil Steam[1]	1.98	2.87	17.98	22.83
Hydroelectric	4.22	2.89	NA	7.10
Other[2]	8.78	13.44	42.61	64.84
Average	**3.72**	**3.44**	**15.47**	**22.62**

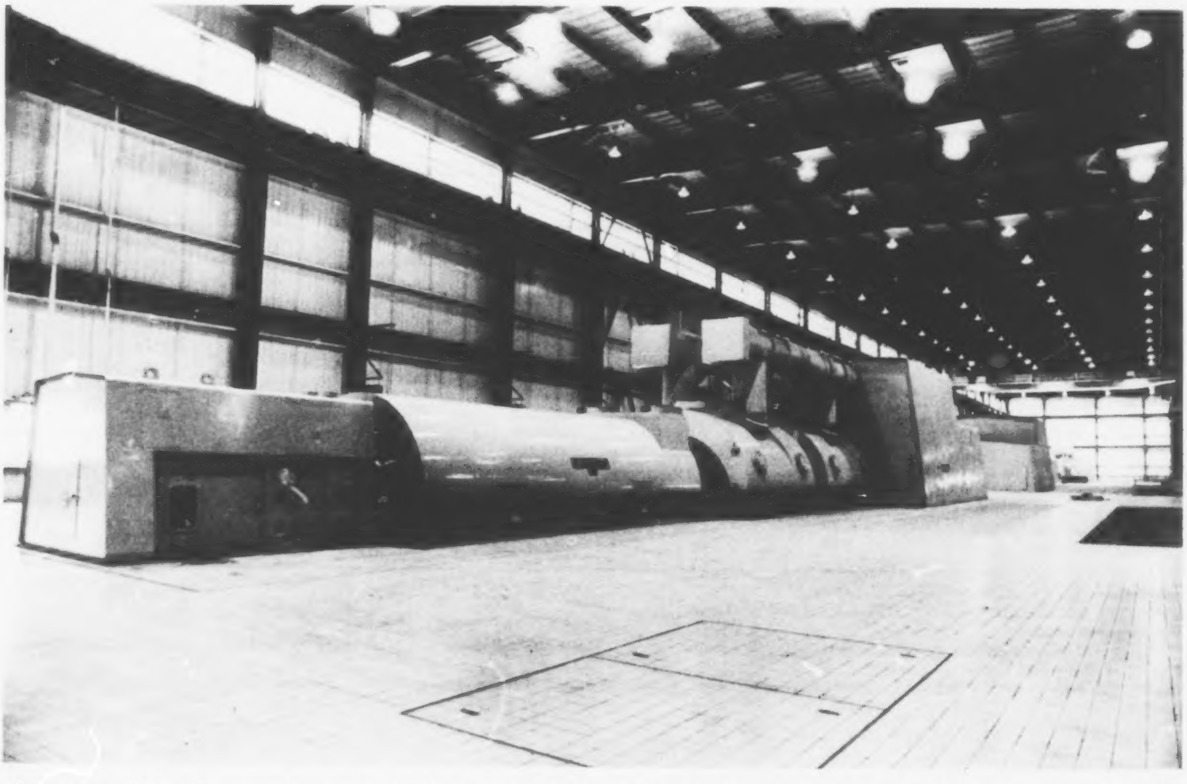
[1] Includes geothermal.
[2] Includes gas turbine, internal combustion, solar, and wind plants.
NA = Not applicable.
Notes: •Expenses are average expenses weighted by net generation. •Totals may not equal sum of components because of independent rounding. •Data for 1988 are preliminary.
Source: Federal Energy Regulatory Commission, FERC Form 1, "Annual Report of Major Electric Utilities, Licensees and Others."

Production expenses, which are the costs of generation, typically represent more than one-half of the total delivered charge for electricity to the consumer. Production expenses include the operating expenses of the utility company for producing electricity at power plants and the annual fixed charges and capital-carrying costs associated with those plants.

Operating expenses do not include capital-carrying costs, such as interest on debt, return on equity, depreciation, amortization expenses, and associated taxes. Capital-carrying costs must be added to the operating expenses to obtain total production expenses. The components of the capital-carrying costs, which are reported by the utility to the Energy Information Administration on the statement of income, are collected at the utility level and are not allocated to the different types of plants.

Annual capital-carrying costs vary by utility. Plants of various technologies typically have different investment costs associated with them that result in different capital-carrying charges. However, the annual production expenses are generally lower for high-investment cost plants of the same technology that are designed for greater utilization and efficiency. The selection of alternative generating plants includes this tradeoff of higher capital-carrying costs and lower operating costs versus alternatives with lower capital-carrying costs but higher production expenses.

The expenses presented in Table A1 are based on utility operating expenses for all plants owned by major private utilities. Data in Table A1 are compiled from information contained on the Federal Energy Regulatory Commission FERC Form 1, "Annual Report of Electric Utilities, Licensees, and Others." This form is used annually to collect accounting, financial, and operating data from selected major electric utilities that are privately owned (approximately 180 utilities). More detailed information on operating expenses and capital-carrying costs for selected plants of these major utilities is published in the *Historical Plant Cost and Annual Production Expenses for Selected Electric Plants (HPCAPE).*[12] The operating expenses in the HPCAPE are the average of these selected plants and therefore will not equal the operating expenses in Table A1.



Operation and maintenance expenses consist of maintaining the physical condition and operating efficiency of the plant, including the generation room shown here.

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[12] Energy Information Administration, *Historical Plant Cost and Annual Production Expenses for Selected Electric Plants*, DOE/EIA-0455.

Appendix B

Planned Capability Additions

Appendix B

Planned Capability Additions

Electric utilities are dedicated to providing a continuous and dependable supply of electricity to their consumers. They must maintain a balance between supply and demand and, at the same time, maintain an adequate reserve margin to ensure system reliability. To accomplish this, electric utilities continually assess their need for new electric generating capability. This appendix contains a summary of planned capability additions at the national, regional, and State levels during the period, 1989 through 1998.

Growth in the demand for electricity is the most important factor in determining the need for new electric generating capability. (Growth in demand is influenced by certain economic forces, primarily the Gross National Product and the cost of fuels and electricity). Two additional factors that contribute to the need for new generating capability are the retirements of older generators and the decreasing efficiency of aging generating units. Electric utilities continually monitor their peak demands and energy requirements and usually update their forecasts of these annually. Various methodologies are used by electric utilities to forecast annual peak demands and energy requirements. After the level of growth in peak demand has been determined, utilities must determine the amount of generating capacity that is needed to meet the expected growth.

Once the decision to add new capability has been made, the type of capability to be added is determined by matching the load to be served with the appropriate type of generating unit. If the needs of a utility are limited to capability required to meet peak demand, then gas turbine, internal-combustion, or pumped-storage hydroelectric generating units are likely to be the choice for new additions. To meet other energy requirements (intermediate and base loads), the options available to the utility include the addition of steam-electric, combined-cycle, or conventional-hydroelectric generating units.

Before deciding to add new capability, electric utilities consider other options that may be more cost-effective in meeting future demand. Also, they may choose to combine the addition of new capability with other options that include repowering and/or life extension of their existing capability, load management programs and/or purchases of power from nonutilities.

The data in the tables were obtained from the Energy Information Administration (EIA) Form EIA-860, "Annual Electric Generator Report." The number of generators are reported since this is a count of the physical equipment rather than generating units, which are a combination of one or more boilers, turbines, and generators operated together to produce electricity. Data are reported annually on Form EIA-860 by approximately 900 electric utilities in the United States that operate power plants or plan to operate power plants within 10 years of the reporting year. These 10-year plans include generating units that are under construction or in various stages of planning at the time data are submitted. More detailed data are published in the *Inventory of Power Plants in the United States.*[13]

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[13] Energy Information Administration, *Inventory of Power Plants in the United States*, DOE/EIA-0095.

Table B1. Planned Capability Additions by Energy Source, 1989-1998

Year	Total		Petroleum & Gas		Coal		Nuclear		Hydroelectric		Other[1]	
	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)
1989	**73**	**9,044**	47	1,500	3	1,991	5	5,445	16	105	2	3
1990	**33**	**2,515**	13	327	3	1,011	1	1,055	13	52	3	71
1991	**31**	**5,597**	8	415	5	2,489	2	2,320	15	372	1	1
1992	**24**	**2,642**	10	582	2	1,138	0	0	9	838	3	84
1993	**35**	**1,729**	17	1,104	0	0	0	0	15	434	3	192
1994	**18**	**2,614**	8	839	2	1,500	0	0	7	200	1	75
1995	R **25**	R **5,963**	R 11	R 1,457	5	2,212	1	1,170	7	933	1	191
1996	**29**	**4,071**	23	2,428	3	1,553	0	0	2	61	1	29
1997	**16**	**3,423**	8	1,346	5	2,023	0	0	2	25	1	29
1998	**16**	**1,529**	11	645	1	645	0	0	3	9	1	29

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[1] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.
[2] Net summer capability.
R = Revised data.
MW = megawatts.
Notes: •Totals may not equal sum of components because of independent rounding. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table B2. Planned Capability Additions by Energy Source and North American Electric Reliability Council Region, Alaska, and Hawaii, 1989-1998

North American Electric Reliability Council Region, Alaska, and Hawaii	Total		Petroleum & Gas		Coal	
	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)
ECAR	24	4,098	16	898	5	3,125
ERCOT	26	9,869	7	749	12	5,560
MAAC	28	3,732	26	2,037	1	640
MAIN	20	752	19	749	0	0
MAPP(U.S.)	15	725	13	300	1	423
NPCC(U.S.)	33	2,379	4	196	0	0
SERC	R 61	R 11,829	R 40	R 4,643	3	1,459
SPP	22	807	19	773	0	0
WSCC(U.S.)	65	4,876	10	472	7	3,355
Contiguous U.S.	R **294**	R **39,066**	R **154**	R **10,816**	**29**	**14,562**
Alaska	4	35	0	0	0	0
Hawaii	2	27	2	27	0	0
U.S. Total	R **300**	R **39,127**	R **156**	R **10,843**	**29**	**14,562**

North American Electric Reliability Council Region, Alaska, and Hawaii	Nuclear		Hydroelectric		Other[2]	
	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)
ECAR	0	0	3	75	0	0
ERCOT	3	3,550	4	10	0	0
MAAC	1	1,055	0	0	0	0
MAIN	0	0	1	3	0	0
MAPP(U.S.)	0	0	0	0	1	2
NPCC(U.S.)	2	1,959	27	224	0	0
SERC	3	3,426	8	1,966	7	335
SPP	0	0	3	34	0	0
WSCC(U.S.)	0	0	39	682	9	367
Contiguous U.S.	**9**	**9,990**	**85**	**2,993**	**17**	**704**
Alaska	0	0	4	35	0	0
Hawaii	0	0	0	0	0	0
U.S. Total	**9**	**9,990**	**89**	**3,028**	**17**	**704**

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[1] Net summer capability.
[2] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.
R = Revised data.
MW = megawatts.
Notes: •Totals may not equal sum of components because of independent rounding. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table B3. Planned Capability Additions by Energy Source, Census Division, and State, 1989-1998

Census Division and State	Total		Petroleum & Gas		Coal	
	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)	Number of Generators	Capability[1] (MW)
New England	**13**	**1,221**	**1**	**1**	**0**	**0**
Connecticut	0	0	0	0	0	0
Maine	6	62	0	0	0	0
Massachusetts	2	1	0	0	0	0
New Hampshire	1	1,150	0	0	0	0
Rhode Island	1	1	1	1	0	0
Vermont	3	7	0	0	0	0
Middle Atlantic	**30**	**3,095**	**12**	**1,077**	**0**	**0**
New Jersey	9	883	9	883	0	0
New York	20	1,158	3	195	0	0
Pennsylvania	1	1,055	0	0	0	0
East North Central	**40**	**4,220**	**34**	**1,585**	**4**	**2,630**
Illinois	5	80	5	80	0	0
Indiana	2	1,367	1	67	1	1,300
Michigan	0	0	0	0	0	0
Ohio	17	2,099	14	769	3	1,330
Wisconsin	16	674	14	669	0	0
West North Central	**31**	**1,286**	**30**	**863**	**1**	**423**
Iowa	8	230	8	230	0	0
Kansas	6	16	6	16	0	0
Minnesota	1	1	1	1	0	0
Missouri	14	550	14	550	0	0
Nebraska	1	66	1	66	0	0
North Dakota	1	423	0	0	1	423
South Dakota	0	0	0	0	0	0
South Atlantic	**R 69**	**R 9,439**	**R 52**	**R 5,412**	**1**	**640**
Delaware	4	271	4	271	0	0
District of Columbia	2	171	2	171	0	0
Florida	R 21	R 2,126	R 19	R 2,009	0	0
Georgia	4	1,956	0	0	0	0
Maryland	12	1,352	11	712	1	640
North Carolina	0	0	0	0	0	0
South Carolina	14	1,604	6	421	0	0
Virginia	12	1,958	10	1,828	0	0
West Virginia	0	0	0	0	0	0
East South Central	**15**	**4,816**	**6**	**447**	**4**	**1,954**
Alabama	8	1,844	5	385	3	1,459
Kentucky	5	632	1	62	1	495
Mississippi	0	0	0	0	0	0
Tennessee	2	2,340	0	0	0	0
West South Central	**31**	**10,112**	**9**	**958**	**12**	**5,560**
Arkansas	3	34	0	0	0	0
Louisiana	0	0	0	0	0	0
Oklahoma	1	192	1	192	0	0
Texas	27	9,885	8	766	12	5,560
Mountain	**34**	**4,177**	**9**	**430**	**7**	**3,355**
Arizona	8	1,047	5	174	2	720
Colorado	1	485	0	0	1	485
Idaho	4	75	0	0	0	0
Montana	0	0	0	0	0	0
Nevada	9	2,155	4	256	3	1,750
New Mexico	0	0	0	0	0	0
Utah	12	414	0	0	1	400
Wyoming	0	0	0	0	0	0
Pacific Contiguous	**31**	**699**	**1**	**41**	**0**	**0**
California	25	649	1	41	0	0
Oregon	0	0	0	0	0	0
Washington	6	50	0	0	0	0
Pacific Noncontiguous	**6**	**61**	**2**	**27**	**0**	**0**
Alaska	4	35	0	0	0	0
Hawaii	2	27	2	27	0	0
U.S. Total	**R 300**	**R 39,127**	**R 156**	**R 10,843**	**29**	**14,562**

[1] Net summer capability.

R = Revised data.

MW = megawatts.

Notes: •Totals may not equal sum of components because of independent rounding. •Data are revised from the *Inventory of Plants in the United States 1988*. See Appendix D for further explanation.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table B3. Planned Capability Additions by Energy Source, Census Division, and State, 1989-1998 (Continued)

Census Division and State	Nuclear		Hydroelectric		Other[1]	
	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)	Number of Generators	Capability[2] (MW)
New England	**1**	**1,150**	**11**	**70**	**0**	**0**
Connecticut	0	0	0	0	0	0
Maine	0	0	6	62	0	0
Massachusetts	0	0	2	1	0	0
New Hampshire	1	1,150	0	0	0	0
Rhode Island	0	0	0	0	0	0
Vermont	0	0	3	7	0	0
Middle Atlantic	**2**	**1,864**	**16**	**154**	**0**	**0**
New Jersey	0	0	0	0	0	0
New York	1	809	16	154	0	0
Pennsylvania	1	1,055	0	0	0	0
East North Central	**0**	**0**	**1**	**3**	**1**	**2**
Illinois	0	0	0	0	0	0
Indiana	0	0	0	0	0	0
Michigan	0	0	0	0	0	0
Ohio	0	0	0	0	0	0
Wisconsin	0	0	1	3	1	2
West North Central	**0**	**0**	**0**	**0**	**0**	**0**
Iowa	0	0	0	0	0	0
Kansas	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0
Missouri	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0
South Atlantic	**1**	**1,086**	**8**	**1,966**	**7**	**335**
Delaware	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0
Florida	0	0	0	0	2	117
Georgia	1	1,086	3	870	0	0
Maryland	0	0	0	0	0	0
North Carolina	0	0	0	0	0	0
South Carolina	0	0	5	1,095	3	88
Virginia	0	0	0	0	2	130
West Virginia	0	0	0	0	0	0
East South Central	**2**	**2,340**	**3**	**75**	**0**	**0**
Alabama	0	0	0	0	0	0
Kentucky	0	0	3	75	0	0
Mississippi	0	0	0	0	0	0
Tennessee	2	2,340	0	0	0	0
West South Central	**3**	**3,550**	**7**	**43**	**0**	**0**
Arkansas	0	0	3	34	0	0
Louisiana	0	0	0	0	0	0
Oklahoma	0	0	0	0	0	0
Texas	3	3,550	4	10	0	0
Mountain	**0**	**0**	**16**	**243**	**2**	**149**
Arizona	0	0	1	153	0	0
Colorado	0	0	0	0	0	0
Idaho	0	0	4	75	0	0
Montana	0	0	0	0	0	0
Nevada	0	0	0	0	2	149
New Mexico	0	0	0	0	0	0
Utah	0	0	11	14	0	0
Wyoming	0	0	0	0	0	0
Pacific Contiguous	**0**	**0**	**23**	**439**	**7**	**218**
California	0	0	17	389	7	218
Oregon	0	0	0	0	0	0
Washington	0	0	6	50	0	0
Pacific Noncontiguous	**0**	**0**	**4**	**35**	**0**	**0**
Alaska	0	0	4	35	0	0
Hawaii	0	0	0	0	0	0
U.S. Total	**9**	**9,990**	**89**	**3,028**	**17**	**704**

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[1] Includes geothermal, refuse, waste heat, waste steam, solar, wind, and wood.

[2] Net summer capability.

MW = megawatts.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Appendix C

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Appendix C

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Appendix D

Technical Notes

Appendix D

Technical Notes

Sources of Data

The *Electric Power Annual* is prepared by the Electric Power Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration (EIA), U.S. Department of Energy (DOE). Data published in the *Electric Power Annual* are compiled from two statistical forms filed monthly and six forms filed annually by electric utilities. Those forms are: the Form EIA-759, "Monthly Power Plant Report"; the FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants"; the Form EIA-860, "Annual Electric Generator Report"; the Federal Energy Regulatory Commission (FERC) Form 1, "Annual Report of Major Electric Utilities, Licensees, and Others"; the Form EIA-767, "Steam-Electric Plant Operation and Design Report"; the Form EIA-861, "Annual Electric Utility Report"; the Department of Energy Form IE-411, "Coordinated Bulk Power Supply Program"; and the Economic Regulatory Administration, Form ERA-781R, "Annual Report of International Electric Import/Export Data." A brief summary of each form is presented below.

Form EIA-759

The Form EIA-759 is a mandatory census of all operators of electric utility plants producing electric power for public use. The Form EIA-759 is used to collect monthly data on net generation, consumption of coal, petroleum, and natural gas; and end-of-the-month stocks of coal and petroleum for each plant by prime mover and fuel-type combination. Summary data from the Form EIA-759 are also published in the *Electric Power Monthly (EPM)*, the *Monthly Energy Review (MER)*, *Annual Outlook for U.S. Electric Power(AOEP)*, and the *Annual Energy Review (AER)*. These reports present aggregated data for electric utilities at the U.S., Census division, and North American Electric Reliability Council Region (NERC) levels.

Instrument and Design History. Prior to 1936, the Bureau of the Census and the U.S. Geological Survey collected, compiled, and published data on the electric power industry. In 1936, the Federal Power Commission (FPC) assumed all data collection and publication responsibilities for the electric power industry and implemented the FPC Form 4. The Federal Power Act, Sections 311 and 312, and FPC Order 141 define the legislative authority to collect power production data. The Form EIA-759 replaced the FPC Form 4 in January 1982.

Data Processing. The Form EIA-759, along with a return envelope, is mailed to respondents approximately 4 working days before the end of the month. The respondents names are obtained from a computerized mailing address file. The completed forms are to be returned to the EIA by the 10th day after the end of the reporting month. After receipt, data from the completed forms are manually logged in and edited before being keypunched for automatic data processing. An edit program checks the data for errors not found during manual editing. The electric utility companies are telephoned to obtain data in cases of missing reports and to verify data when questions arise during editing. Following verification of the data, text and tables of aggregated data are produced for inclusion in the *EPM*. Following EIA approval of the *EPM*, the data are made available for public use, on a cost-recovery basis, through custom computer runs, data tapes, or in publications.

FERC Form 423

The FERC Form 423 is a monthly record of delivered-fuel purchases, submitted by approximately 225 electric utilities for each plant with a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts. Summary data from the FERC Form 423 are also published in the *EPM*, the *MER*, and the *Cost and Quality of Fuels for Electric Utility Plants - Annual*. These reports present aggregated data on electric utilities at the U.S. and Census division level.

Instrument and Design History. On July 7, 1972, the FPC issued Order Number 453 enacting the New Code of Federal Regulations, Section 141.61, legally creating the Form 423. Originally, the form was used to collect data only on fossil-steam plants, but was amended in 1974 to include data on internal combustion and combustion turbines. The FERC Form 423 replaced the FPC Form 423 in January 1983. Peaking units, which were previously collected on the FPC Form 423 were

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eliminated from the FERC Form 423. In addition, the nameplate capacity threshold was changed from 25 megawatts to 50 megawatts. This reduction in coverage eliminated approximately 50 utilities and 250 plants. All FPC Form 423 historical data in this publication have been revised to reflect the new nameplate capacity threshold of 50 or more megawatts.

Data Processing. A computerized mailing-address file is used to send a 6-month supply of forms to respondents semiannually. Completed forms are to be returned to the EIA by the 45th day following the end of the reporting month. Data from the completed forms are manually logged in and edited before being keypunched for automatic data processing. The electric utility companies are telephoned to obtain data in cases of missing reports and to verify data when questions arise during editing. Following verification of the data, text and tables of aggregated data are produced for inclusion in the *EPM*. After the *EPM* receives EIA approval, the data become available for public use, on a cost-recovery basis, through custom computer runs, data tapes, or in publications.

Form EIA-861

The Form EIA-861 is a mandatory census of electric utilities in the United States, its territories, and Puerto Rico. The Form EIA-861 data contained in this publication are for the United States only. The survey is used to collect information on power production and sales data from approximately 3,250 electric utilities. The data collected are used to maintain and update the EIA's electric utility frame data base. This data base supports queries from the Executive Branch, Congress, other public agencies, and the general public. Summary data from the Form EIA-861 are also contained in the *EPM*, the *Typical Electric Bills*, the *Financial Statistics of Selected Electric Utilities*, and the *Annual Outlook for U.S. Electric Power*. These reports present aggregate totals for electric utilities on a national level, by State, and by ownership type.

Instrument and Design History. The Form EIA-861 was implemented in January 1985 to collect data as of year-end 1984. The Federal Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

Data Processing. The Form EIA-861 is mailed to the respondents in February to collect data as of the end of the preceding calendar year. The completed forms are to be returned to the EIA by May 1. The data are manually edited before being entered into the interactive on-line system. Internal edit checks are performed to verify that current data total across and between schedules, and are comparable to data reported the previous year. Edit checks are also performed to compare data reported on the Form EIA-861 and similar data reported on the Forms EIA-826, "Monthly Electric Utility Sales and Revenue Report with State Distributions," the FERC Form 1, and the Form EIA-412, "Annual Report of Public Electric Utilities." These are utility-level checks. Respondents are telephoned to obtain clarification of reported data and to obtain missing data.

Form EIA-861 figures shown in this publication differ somewhat from the sum of the monthly Form EIA-826 figures for sales published in the *EPM* and in previous issues of the *Electric Power Annual*. Both forms use sectoral classifications (residential, commercial, and industrial) based on the utilities' usual classification of customers. At the national level, the Form EIA-861 and Form EIA-826 figures corresponded closely (within 3 percent) for all end-use sectors. Some larger differences were observed at the State level particularly for Tennessee due to a misclassification of commercial and industrial data in the Form EIA-826 survey.

Detailed comparisons and descriptions of conceptual problems affecting the quality of the data are discussed in the report, *An Assessment of the Quality of Selected EIA Data Series: Electric Power Data*. (See Item 10 in Appendix C for the reference.) One example of such a problem inherent in data on electricity sales is that the sectoral classification scheme can vary from utility to utility as influenced by the local public utility commission.

Differences between the Form EIA-861 and Form EIA-826 figures can result from the Form EIA-826 sampling procedure and/or from nonsampling error in either data collection. One source of nonsampling error in the Form EIA-826 stems from the practice of filing estimates when the actual figures are not yet available. Although respondents are instructed to file revisions, revisions are not always filed. In addition, the respondents have been instructed to review their Form EIA-826 figures at the end of the reporting year to ensure consistency with Form EIA-861 figures. The EIA compares these data series and attempts to resolve any differences. Nevertheless some reporting differences remain.

Form EIA-860

The Form EIA-860 is a mandatory census of electric utilities in the United States that operate power plants or plan to operate a power plant within 10 years of the reporting year. The survey is used to collect data on electric utilities' existing power plants and their 10-year plans for constructing new plants, and modifying and retiring existing plants. Data on the survey are collected at the generating unit level. These data are then aggregated to provide totals by energy source (coal, petroleum, gas, water, nuclear, other) and geographic area (State, NERC region, Federal region, Census division). Additionally, at the national level, data are aggregated to provide totals by prime mover. Data from the Form EIA-860 are also summarized in the *Inventory of Power*

Plants in the United States, and are used as input to publications and studies by other offices in the DOE.

Instrument and Design History. The Form EIA-860 was implemented in January 1985 to collect data as of year-end 1984. The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

Data Processing. The Form EIA-860 is mailed to approximately 900 respondents in December to collect data as of the end of the preceding calendar year. The completed forms are to be returned to the EIA by February 15. Data for each respondent are preprinted from the applicable data base. Respondents are instructed to verify all preprinted data and to supply missing data. The data are manually edited before being keyed for automatic data processing. Computer programs containing additional edit checks are run. Respondents are telephoned to obtain correction or clarification of reported data and to obtain missing data, as a result of the manual and automatic editing process.

Form EIA-767

The Form EIA-767 is a mandatory census of all operators of plants with a total existing or planned fossil-fueled steam-electric nameplate capacity of 10 or more megawatts. The entire form, including nameplate capacity and environmental equipment, is filed by 700 power plants with a nameplate capacity of 100 or more megawatts. Power plants with a nameplate capacity between 10 and 100 megawatts submit information only on fuel consumption and flue gas desulfurization equipment. The Form EIA-767 is used to collect data annually on plant operations and equipment design (including boiler, generator, cooling system, flue gas desulfurization, flue gas particulate collectors, and stack data). Data from the Form EIA-767 are used for economic, regulatory, and environmental analyses conducted by the DOE, the FERC, the Environmental Protection Agency, and the Department of Commerce.

Instrument and Design History. The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data. The predecessor form, FPC-67, "Steam-Electric Plant Air and Water Quality Control Data," was used to collect data from 1969 to 1980, when the form number was changed to Form EIA-767. In 1982, the form was completely redesigned and given the name Form EIA-767, "Steam-Electric Plant Operation and Design Report." In 1986, the respondent universe of 700 was increased to 900 to include plants with nameplate capacity from 10 megawatts to 100 megawatts. Respondents for these 200 additional plants complete only pages 1, 6, and, if applicable, 13, and 14.

Data Processing. The Form EIA-767 is mailed to respondents in January to collect data as of the end of the preceding calendar year. The completed forms are to be returned to the EIA by May 1. Equipment design data for each respondent are preprinted from the applicable data base. Respondents are instructed to verify all preprinted data and to supply missing data. The data are manually edited before being keyed for automatic data processing. Computer programs containing additional edit checks are run. Respondents are telephoned to obtain correction or clarification of reported data and to obtain missing data, as a result of the manual and automatic editing process.

FERC Form 1

The FERC Form 1 is a mandatory annual survey of major privately owned electric utilities having, in each of the last 3 consecutive years, sales or transmission service that exceeds any one or more of the following: (1) 1 million megawatthours of total sales, (2) 100 megawatthours of sales for resale, (3) 500 megawatthours of gross interchange out, or (4) 500 megawatthours of wheeling for others (deliveries plus losses). All major public utilities, licensees, or others subject to the Federal Power Act of 1935 must submit this form to the EIA. Classification of such entities is provided in the FERC Uniform System of Accounts Prescribed for Public Utilities and Licensees Subject to the Provisions of the Federal Power Act. Approximately 180 electric utilities are classified as major. Excluded from EIA publications are Northeast Nuclear Energy Company, whose data were not included to prevent double counting of data for the Millstone nuclear plant, which Northeast Nuclear Energy Company operates for Connecticut Light & Power Company and Western Massachusetts Electric Company; and Golden Spread Electric Cooperative, whose data were not included since it is classified as a cooperative on the Form EIA-861. The FERC, however, has determined that Golden Spread Electric Cooperative should file a FERC Form 1 under Section 201 of the Federal Power Act.

The FERC Form 1 is used to collect data on income and earnings, taxes, depreciation and amortization, distribution of salaries and wages, electric operating revenues, electric maintenance expenses, generating plant statistics, planned construction data, year-end balance sheets, and general corporate information. Respondents are required to report data on historical plant cost and power production expenses for their hydroelectric plants with a generator nameplate capacity of 10 megawatts or larger; each steam-electric plant with a generator nameplate capacity of 25 megawatts or more; and each gas-turbine plant with a generator nameplate capacity of 10 megawatts or larger. Less detailed data are required for other plants.

Instrument and Design History. The Federal Power Commission's (FPC) Form 1, the predecessor of the FERC Form 1, was implemented in 1935 by the FPC. When the FPC was merged with the DOE in October

1977, the collection and processing of data on the form became the responsibility of the EIA. This mandatory survey is conducted in accordance with the FERC Uniform System of Accounts for Private Utilities and Licensees.

Data Processing. The completed forms are to be returned to the EIA on or before April 30, containing data for the preceding calendar year. Manual editing of the reported data is completed prior to data entry. Additional edit checks of the data are performed through computer programs. The program edits include both deterministic checks, in which records are checked for the presence of data in required fields, and statistical checks, in which the data are checked against a range of values based on historical data values and for logical or mathematical consistency with data elements reported in the form. Discrepancies found in the data, as a result of these checks, are resolved either by the processing office or by further information obtained from a telephone call to the respondent company.

Form IE-411

The Form IE-411 is filed annually as a voluntary report. The information reported includes: (1) actual energy and peak demand for the preceding year and 10 additional years; (2) existing and future generating capacity; (3) scheduled capacity transfers; (4) projections of capacity, demand, purchases, sales, and scheduled maintenance; (5) assessment of adequacy; (6) generating capacity unavailability; (7) bulk power system maps; (8) near term transmission adequacy; (9) future critical bulk power facilities that may not be in service when required; and, (10) system evaluation criteria. These data support queries from the executive branch, Congress, other public agencies, and the general public. These reports present various council aggregate totals for electric utilities.

Instrument and Design History. The Form IE-411 program was initiated under the Federal Power Commission Docket R-362, reliability and adequacy of electric service, and Orders 383-2, 383-3, and 383-4. The Department of Energy, established in October 1977, assumed the responsibility for this activity. This form is considered voluntary under the authority of the Federal Power Act (Public Law 88-280), The Federal Energy Administration Act of 1974 (Public Law 93-275), and the Department of Energy Organization Act (Public Law 95-91). It is now under the jurisdiction of the Assistant Secretary for International Affairs and Energy Emergencies.

Data Processing. The Form IE-411 is filed annually on April 1 by the nine North American Electric Reliability Councils. The forms are compiled from data furnished by electric utilities within the council areas. Data from the Form IE-411 are also summarized in the staff report *Electric Power Supply and Demand for the Contiguous United States* (DOE/IE-0013), and are used as input to publications and studies by other offices in the DOE.

Form ERA-781R

The Form ERA-781R, "Annual Report of International Electrical Export/Import Data" is used to collect on an annual basis, monthly information on the gross amounts of electrical energy received and delivered and the costs and revenues associated with these transactions. The use of the format contained in Form ERA-781R is optional for reporting purposes; however, submission of the data is mandatory.

Instrument and Design History. The authority to issue presidential permits pursuant to Executive Order Number 10485 was transferred to the Secretary of Energy by Executive Order Number 12038 (43 FR 4957 February 7, 1987). This responsibility was delegated by the Secretary to the Economic Regulatory Administration (DOE Delegation Order Number 0204-04, October 1, 1977). The authority was redelegated (DOE Delegation Order Number 127) to the Office of Fuels Programs, the Office of Fossil Energy (54 FR 11436 March 20, 1989). The survey universe is defined under Title 10 of the Code of Federal Regulations, Sections 205.308 and 205.325 to include all public utilities or other entities subject to the Department of Energy jurisdiction under Part II of the Federal Power Act engaged in the export of electric energy across the international borders of the United States with Canada and Mexico. It also includes those engaged in the transmission of electrical energy across these borders who hold a presidential permit.

Data Processing. The Form ERA-781R is mailed to the respondents to collect annually, the monthly data for the preceding calendar year. The completed forms are to be returned to the DOE by February 15. The receipts are manually edited and the data used for the Presidential Permit Program are entered into a machine readable format.

Quality of Data

The Office of Coal, Nuclear, Electric and Alternate Fuels (CNEAF) is responsible for routine data improvement and quality assurance activities. All operations in this office are done in accordance with formal standards established by the EIA. These standards are the measuring rod necessary for quality statistics. Data improvement efforts include verification of data-keyed input by automatic computerized methods, editing by subject matter specialists, and follow-up on nonrespondents. The CNEAF office supports the quality assurance efforts of the data collectors by providing advisory reviews of the structure of information requirements, and of proposed designs for new and revised data collection forms and systems. Once implemented, the actual performance of working data collection systems is also validated. Computerized respondent data files are checked to identify those who fail to respond to the survey. By law, nonrespondents may be fined or otherwise penalized for not filing a mandatory EIA data form. Before invoking the law, the EIA tries to obtain the required information by encouraging cooperation of nonrespondents.

Completed forms received by the CNEAF office are sorted, screened for completeness of reported information, and keyed onto computer tapes for storage and transfer to random access data bases for computer processing. The information coded on the computer tapes is manually spot-checked against the forms to certify accuracy of the tapes. To ensure the quality standards established by the EIA, formulas that use the past history of data values in the data base have been designed and implemented to check data input for errors automatically (see items 3 and 6 in Appendix C). Data values that fall outside the ranges prescribed in the formulas are verified by telephoning respondents to resolve any discrepancies.

Conceptual problems affecting the quality of data are discussed in the report, *An Assessment of the Quality of Selected EIA Data Series: Electric Power Data.* This report is published by the Energy Information Administration (Office of Statistical Standards, see item 10 in Appendix C).

Data Editing System

Data from the form surveys are edited using automated systems. The edit includes both deterministic checks, in which records are checked for the presence of required fields and their validity; and statistical checks, in which estimation techniques are used to validate data according to their behavior in the past and in comparison to other current fields.

Confidentiality of the Data

The data collected on the forms used for input to this report are not confidential.

Rounding Rules for Data

Given a number with r digits to the left of the decimal and d+t digits in the fraction part, with d being the place to which the number is to be rounded and t being the remaining digits which will be truncated, this number is rounded to r+d digits by adding 5 to the (r+d+1)th digit when the number is positive or by subtracting 5 when the number is negative. The t digits are then truncated at the (r+d+1)th digit. The symbol for a rounded number truncated to zero is (*).

Data Correction and Revision Procedures

The CNEAF office has adopted the following policy with respect to the revision and correction of data published in energy data reports and made available in a machine format:

1. All data collected by this office (excluding secondary source data) will be published as preliminary data when first appearing in an energy data report.
2. The next publication of the data will be in final form at which point the data base is closed.
3. Revisions or corrections will be made only in the event a substantial (greater than 1 percent) reporting change is received or a substantial (greater than 1 percent) error is discovered.
4. Revisions or corrections to published secondary source data will be made if and when the organization from which the data were received revises or corrects the data.
5. No revisions will be made without the approval of the Director, Electric Power Division.

The *Electric Power Annual* presents the most current annual data available to the EIA. The statistics may differ from those published previously in the *Electric Power Monthly* due to corrections, revisions, or other adjustments that may have been made to the data subsequent to the original monthly submissions (Table D1). Data in this publication have been revised to reflect the elimination of gas-turbine generators from data reported on the FERC Form 423 and published in earlier issues of the *Electric Power Annual.* This data revision was already reflected in the publication *Cost and Quality of Fuels for Electric Utility Plants 1988.* The sales of electricity values for 1986, 1985, and 1984 published in the *Electric Power Monthly* and earlier issues of the *Electric Power Annual* have been revised. These revisions represent a 0.01, -0.07, and 0.04 percent change in sales of electricity respectively, at the national level. In addition, data published in the *Inventory of Power Plants in the United States 1988* have been revised in this publication to reflect reallocation of 438 megawatts of operable capability on-line in 1988 from petroleum to coal. This revision represents a change of 0.1 percent for coal-fired capability and -0.6 percent for petroleum-fired capability at the national level. Also, 606 megawatts of planned capability from petroleum and gas projected for 1995 have been deleted. This revision represents a change of 5.3 percent for petroleum and gas planned capability through 1998 for the United States.

Table D1. Comparison of Preliminary Versus Final Published Data at the National Level, 1988

Item	Preliminary	Final	Percent Change
Generation (gigawatthours)			
Coal	1,538,203	1,540,653	0.16
Petroleum	148,819	148,900	.05
Gas	252,779	252,801	.01
Hydroelectric	222,938	222,940	*
Nuclear	526,901	526,973	.01
Other[1]	11,984	11,984	0
Consumption			
Coal (1,000 short tons)	757,522	758,372	.11
Petroleum (1,000 barrels)	247,768	248,096	.13
Gas (million cubic feet)	2,634,804	2,635,613	.03
Stocks[2]			
Coal (1,000 short tons)	146,145	146,507	.25
Petroleum (1,000 barrels)	69,273	69,285	.02
Receipts			
Coal (1,000 short tons)	725,862	727,776	.26
Petroleum (1,000 barrels)	238,846	236,923	-.81
Gas (million cubic feet)	2,390,864	2,362,721	-1.18
Average Cost (cents per million Btu)			
Coal	146.7	146.6	-.07
Petroleum	244.0	243.9	-.04
Gas	226.5	226.3	-.09

[1] Includes geothermal, wood, wind, waste, and solar.

[2] Stocks are shown as of December 31 of each year.

* Value less than 0.01.

Note: Percent change is calculated before rounding.

Sources: •Generation, consumption, and stocks: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report." •Receipts and cost: Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

Formulas and Calculations

Average Heat Content

In order to determine the Btu value per unit of consumption (Table D2) for each of the fossil fuels collected on the Form EIA-759, the heat content values contained on the FERC Form 423 were used. Data on the FERC Form 423 represent 86 percent of the total generator nameplate capacity for all electric utilities.

Percent Difference

The following formula is used to calculate percent differences.

$$\text{Percent Difference} = \left(\frac{x(t_2) - x(t_1)}{x(t_1)}\right) \times 100,$$

where $x(t_1)$ and $x(t_2)$ denote the quantity at year t_1 and subsequent year t_2.

Form EIA-759

Data for the Form EIA-759 are collected at the plant level. These data are then aggregated to provide geographic totals at the State, Census division, and U.S. level, or totals by type of plant. Consumption of fuel(s) is converted from quantities (in short tons, barrels, or thousand cubic feet) to Btu at the plant level. End-of-month fuel stocks for a single generating plant may not equal beginning-of-the-month stocks, plus receipts, less consumption, for many reasons, including the fact that several plants may share the same fuel stock.

FERC Form 423

Data for the FERC Form 423 are collected at the plant level. These data are then used in the following formulas to produce aggregates and averages for each fuel type at the State, Census division, and U.S. level. For these formulas, receipts and average heat content are at the plant level. For each geographic region, the summation Σ represents the sum of all plants in that geographic region. Additionally,

- For coal, units for receipts (R) are in tons, units for average heat content (A) are in Btu per pound, and the unit conversion (U) is 2,000 pounds per ton;

Table D2. Average Heat Content of Fossil Fuel Receipts by Census Division and State, 1988

Census Division and State	Coal (Btu per ton)	Petroleum (Btu per barrel)	Gas (Btu per thousand cubic feet)
New England	**26,314,520**	**6,318,402**	**1,028,826**
Connecticut	26,277,390	6,302,979	1,030,656
Maine	NA	6,263,541	NA
Massachusetts	26,218,258	6,306,783	1,026,619
New Hampshire	26,665,930	6,491,367	NA
Rhode Island	NA	6,337,386	1,031,821
Vermont	NA	NA	NA
Middle Atlantic	**24,806,125**	**6,281,822**	**1,031,208**
New Jersey	26,647,052	6,221,741	1,033,002
New York	25,628,806	6,292,164	1,030,769
Pennsylvania	24,519,561	6,297,915	1,034,695
East North Central	**22,253,286**	**6,120,072**	**508,695**
Illinois	21,271,495	6,225,490	1,020,547
Indiana	21,668,278	5,758,087	1,002,172
Michigan	23,223,946	6,125,486	* 161,238
Ohio	23,790,406	6,063,511	1,011,610
Wisconsin	19,386,069	5,781,887	1,001,833
West North Central	**17,420,641**	**6,103,015**	**994,159**
Iowa	18,421,959	5,781,191	1,006,516
Kansas	17,956,276	5,965,455	993,147
Minnesota	17,476,991	5,766,438	1,003,412
Missouri	20,808,062	6,232,003	994,442
Nebraska	17,238,700	6,262,168	953,972
North Dakota	13,168,029	5,819,423	1,064,545
South Dakota	12,676,602	5,880,000	NA
South Atlantic	**24,955,380**	**6,324,760**	**1,010,309**
Delaware	25,902,386	6,337,851	1,071,616
District of Columbia	NA	6,030,948	NA
Florida	24,848,748	6,355,361	1,008,120
Georgia	24,345,096	5,994,957	1,022,524
Maryland	25,449,114	6,311,347	1,042,053
North Carolina	25,150,527	5,810,083	NA
South Carolina	25,350,436	5,813,159	1,031,615
Virginia	25,599,158	6,183,194	1,053,794
West Virginia	24,945,502	5,869,595	1,000,000
East South Central	**23,824,776**	**6,151,267**	**1,026,478**
Alabama	24,328,053	5,729,122	1,038,658
Kentucky	23,056,117	5,838,503	1,023,281
Mississippi	25,327,630	6,306,994	1,026,061
Tennessee	24,089,164	5,809,881	NA
West South Central	**15,434,285**	**6,118,398**	**1,035,764**
Arkansas	17,328,042	6,072,875	1,028,856
Louisiana	16,284,863	6,179,371	1,044,862
Oklahoma	17,823,470	6,294,499	1,039,021
Texas	14,608,028	6,026,371	1,033,233
Mountain	**19,474,261**	**6,109,779**	**1,024,481**
Arizona	21,299,931	5,897,906	1,033,767
Colorado	19,543,090	5,754,403	984,542
Idaho	NA	NA	NA
Montana	17,039,802	5,922,000	1,208,367
Nevada	22,159,126	6,229,984	1,026,972
New Mexico	18,072,064	5,875,504	1,025,943
Utah	22,981,031	5,882,471	NA
Wyoming	17,511,246	5,851,430	1,026,405
Pacific Contiguous	**16,438,624**	**6,145,674**	**1,036,188**
California	NA	6,145,928	1,036,188
Oregon	17,056,679	NA	NA
Washington	16,412,833	5,922,000	NA
Pacific Noncontiguous	**NA**	**6,264,847**	**NA**
Alaska	NA	NA	NA
Hawaii	NA	6,264,847	NA
U.S. Total	**20,901,845**	**6,284,303**	**1,028,285**

* Consists mostly of blast furnace gas, which has a average heat content of 83,891 Btu/mcf. For further detailed information, see Table 29 of the "Electric Power Monthly."

NA = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

- For petroleum, units for receipts (R) are in barrels, units for average heat content (A) are in Btu per gallon, and the unit conversion (U) is 42 gallons per barrel;
- For gas, units for receipts (R) are in thousand cubic feet (Mcf), average heat content (A) are in Btu per cubic foot, and the unit conversion (U) is 1,000 cubic feet per Mcf.

Total Btu $= \sum_i (R_i \times A_i \times U)$,

where i denotes a plant; R_i = receipts for plant i; A_i = average heat content for receipts at plant i; and, U = unit conversion;

$$\text{Weighted Average Btu} = \frac{\sum_i (R_i \times A_i)}{\sum_i R_i},$$

where i denotes a plant; R_i = receipts for plant i; and, A_i = average heat content for receipts at plant i.

The weighted average cost in cents per million Btu is calculated using the following formula:

$$\text{Weighted Average Cost} = \frac{\sum_i (R_i \times A_i \times U \times C_i)}{\sum_i (R_i \times A_i)},$$

where i denotes a plant; R_i = receipts for plant i; A_i = average heat content for receipts at plant i; and, C_i = cost in cents per million Btu for plant i.

The weighted average cost in dollars per unit is calculated using the following formula:

$$\text{Weighted Average Cost} = \frac{U \sum_i (R_i \times A_i \times C_i)}{(10^8 \frac{cents}{dollar}) \sum_i R_i}$$

where i denotes a plant; R_i = receipts for plant i; A_i = average heat content for receipts at plant i; U = unit conversion; and, C_i = cost in cents per million Btu for plant i.

Form EIA-860

Data for the Form EIA-860 are submitted at the generating unit level and are then aggregated to provide totals by energy source and geographic area. In addition, at the national level, data are aggregated by prime mover.

Estimated values for net summer and net winter capability for electric generating units were developed by use of a regression formula. Estimates of net summer capability and net winter capability are made for operable nonnuclear electric generating units with no reported capability and for all electric generating units that are under construction or in the planning stage that are not nuclear-powered or coal-fired. The formula is based on reported values in the 1984 data file. The formula is used to estimate values for existing units where data are missing and for projected units. In all formulas, the symbol, *, is an operator meaning multiplied by; the symbol, **, is an operator meaning raised to the specified power (exponent).

For nonnuclear units,

Net Summer Capability equals E**(i plus (ln(generator Nameplate Capacity)*c)), rounded to nearest megawatt,

where

- E, the base of natural logarithms (ln), is approximately 2.71828,
- Generator Nameplate Capacity is expressed in megawatts,
- i is the intercept, and c is the regression coefficient,
- i equals 0.02564, c equals 0.98423, for steam units (Unit Type is Steam Turbine - Boiler (ST)),
- i equals 0.10255, c equals 0.97841, for gas-turbine units (Unit Types are Gas Turbine (GT) and Jet Engine (JE)),
- i equals 0.00397, c equals 0.95914, for combined-cycle units (Unit Types are Combined Cycle Steam Turbine with Supplemental Firing (CA), Combined Cycle - Single Shaft (CS), Combined Cycle Steam Turbine with Only Waste Heat Capability (CW), and Combustion Cycle Combustion Turbine (CT)),
- i equals 0.08865, c equals 1.00966, for internal combustion units (Unit Type is Internal Combustion (diesel) (IC)),
- i equals 0.04963, c equals 1.03738 for conventional and pipeline hydroelectric units (Unit Types are Hydraulic Turbine (HC) and Hydraulic Turbine - Pipeline (HL)),
- i equals 0.00922, c equals 1.00630, for pumped storage hydroelectric units (Unit Type is Hydraulic Turbine - Reversible (pumped storage) (HR)),
- i equals 0.02604, c equals 0.98289, for all other units (Unit Types are Fuel Cell (FC), Steam Turbine - Geothermal (GE), Ocean Thermal Turbine (OC), Photovoltaic (SP), Steam Turbine - Solar (SS), and Wind Turbine (WT)).

Net Winter Capability equals (E**i)*(Generator Nameplate Capacity**c), rounded to nearest megawatt,

where

- E, the base of natural logarithms (ln), is approximately 2.71828,
- Generator Nameplate Capacity is expressed in megawatts for conventional hydroelectric and pipeline hydroelectric units, and in kilowatts for all other unit types,
- i is the intercept, and c is the regression coefficient,
- i equals 0.1614, c equals 0.98373, for steam units (Unit Type is ST),
- i equals 0.2249, c equals 0.97881, for gas-turbine units (Unit Types are GT and JE),
- i equals 0.9626, c equals 0.90413, for combined-cycle units (Unit Types are CA, CS, CW, and CT),
- i equals 0.1378, c equals 1.02501, for internal combustion units (Unit Type is IC),
- i equals 0.0608, c equals 1.02560, for conventional and pipeline hydroelectric units (Unit Types are HC and HL),
- i equals 0.1167, c equals 1.08540, for pumped storage hydroelectric units (Unit Type is HR),
- i equals 0.2859, c equals 0.96587, for all other units (Unit Types are FC, GE, OC, SP, SS, and WT).

Form EIA-861

Data for the Form EIA-861 are collected at the utility level from all electric utilities in the United States, its territories, and Puerto Rico. Form EIA-861 data in this publication are for the United States only. These data are then aggregated to provide geographic totals at the State, NERC Region, Census division, and national level. Sources and disposition of data are also provided by utility class of ownership and retail consumer class of service. The average retail price is calculated by dividing revenue by kilowatthour sales and multiplying by one thousand.

Form EIA-767

This section describes the methodology employed to calculate sulfur dioxide, nitrogen oxide, and carbon dioxide emissions using information contained on Form EIA-767. The methodology used to calculate emissions has been verified by comparing the emissions data presented in this report with the National Acid Precipitation Assessment Program (NAPAP) data.

Uncontrolled Air Pollutant Emissions. Uncontrolled air pollutant emissions are those emissions that would occur in the absence of any control equipment. Uncontrolled sulfur dioxide, nitrogen oxide, and carbon dioxide emissions are determined by multiplying the quantity of fuel burned by an emission factor. An emission factor is the average quantity of pollutant released from a boiler when a unit of fuel is burned.

The source of both the sulfur dioxide and nitrogen oxides emission factors is the Environmental Protection Agency report, *Compilation of Air Pollutant Emission Factors.*[14] Environmental Protection Agency emission factors are based on boiler type and fuel burned. The Environmental Protection Agency emission factors are used in the *Electric Power Annual* (Table D3). Emission factors for carbon dioxide were estimated by the Electric Power Division of the EIA. Emissions of carbon dioxide are generally a function of the amount of carbon in the fuel. Emission factors were estimated for fuel type independent of boiler type.

Uncontrolled emissions of sulfur dioxide and nitrogen oxides do not accurately depict the quantity of emissions released into the atmosphere because they fail to reflect reductions prompted by emission standards. Consequently, controlled emissions are calculated to provide a more accurate estimate of actual emissions.

Controlled Sulfur Dioxide Emissions. Because of regulations controlling sulfur dioxide emissions, many utilities are required to install flue gas desulfurization (FGD) units at their coal-fired plants.[15] FGD units typically remove between 70 and 90 percent of sulfur dioxide emissions. However, it is assumed that utilities operate them only to the degree necessary to meet the most stringent standard that they face. All utilities are required to comply with Federal standards, and some may also be required to comply with State and local standards. State and local standards may be more or less strict than Federal standards. In this study it is assumed that all utilities comply with the most stringent standard that they encounter. Accordingly, controlled sulfur dioxide emissions for each plant are calculated by subtracting the amount that it is required to remove in order to comply with its most stringent emission standard from its uncontrolled emissions level.

In order to calculate controlled sulfur dioxide emissions, plants are divided into five categories depending on whether their most stringent emission standard is: (1) more strict than 1978 Revised New Source Performance Standards (RNSPS); (2) equal to 1978 RNSPS; (3) less strict than 1978 RNSPS but more strict than 1971 NSPS; (4) equal to 1971 New Source Performance Standards (NSPS); or (5) less strict than 1971 NSPS. Plants built prior to 1971 are not required to comply with either standard and therefore face only State and local requirements. These standards are reported on

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[14] Environmental Protection Agency, Office of Air and Radiation, *Supplement A to Compilation of Air Pollutant Emission Factors, Vol. I: Stationary Point and Area Sources,* AP-42 (Research Triangle Park, North Carolina, October 1986).

[15] FGD units may also remove sulfur dioxide emissions from plants that burn both coal and oil.

Table D3. Sulfur Dioxide, Nitrogen Oxide, and Carbon Dioxide Emission Factors

Fuel	Boiler Type[1]	Factors		
		Sulfur Dioxide[2]	Nitrogen Oxides[3]	Carbon Dioxide
Coal (pounds per ton)[4]				
Bituminous	Pulverized Coal--Dry Bottom	39xS	21(15)	209
	Pulverized Coal--Wet Bottom	39xS	34	209
	Cyclone	39xS	37	209
	Spreader Stoker	39xS	14	209
	All Others	39xS	7.5	209
Subbituminous	Pulverized Coal--Dry Bottom	35xS	21(15)	219
	Pulverized Coal--Wet Bottom	35xS	34	219
	Cyclone	35xS	37	219
	Spreader Stoker	35xS	14	219
Anthracite	Pulverized Coal	39xS	18	209
	Stoker	39xS	10	209
Lignite	Pulverized Coal--Front Wall/Opposed Firing	30xS	14	213
	Pulverized Coal--Tangential	30xS	8	213
	Pulverized Coal--All Others	30xS	12	213
	Cyclone	30xS	17	213
	All Others	30xS	6	213
Petroleum (pounds per thousand gallons)				
Residual Heavy Oil	Tangentially Fired	159.9xS	42	180
	Vertically Fired	159.9xS	105	180
	All Others	159.9xS	67	180
Light Distillate	All	144.0xS	20	156
Natural Gas (pounds per million cubic feet)	Tangentially Fired	0.6	275	120
	All Others	0.6	550	120

[1] See the Environmental Protection Agency report for definitions of boiler types.

[2] "xS" indicates that the constant must be multiplied by the percentage (by weight) of sulfur in the fuel. Sulfur dioxide emission factors also account for small quantities of sulfur trioxide and gaseous sulfates.

[3] Parenthetic value is for tangentially fired boilers. Tangentially fired boilers are fired from the corners of the furnace and are capable of directing the fireball in an upward or downward direction.

[4] Coal types are categorized by Btu content in this table as follows: Bituminous (equal to or greater than 9,750 Btu per pound), Subbituminous (equal to 7,500 to 9,750 Btu per pound), and Lignite (less than 7,500 Btu per pound).

Source: Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors*, Volume 1, AP-42(October 1986).

Form EIA-767. Plants built after August 17, 1971, but on or before September 18, 1978, must meet 1971 NSPS. Plants built after September 18, 1978, must meet 1978 RNSPS. Even if a plant is required to comply with NSPS or RNSPS, it still may face State or local standards.

The 1971 NSPS require all plants built after August 17, 1971, to emit no more than 1.2 pounds of sulfur dioxide per million Btu of heat input. Utilities are allowed to meet this standard by either burning low-sulfur coal or using FGD units. The 1978 RNSPS are more complex. All plants built after September 18, 1978 are required to use FGD units. If they burn coal that has a sulfur content per million Btu (1) less than 1 pound, they must remove 70 percent of the sulfur dioxide; (2) between 1 and 3 pounds, they must remove the amount (between 70 and 90 percent) that yields a sulfur dioxide emission rate of 0.6 pounds per million Btu; (3) between 3 and 6 pounds, they must remove 90 percent; and (4) greater then 6 pounds they must remove the amount that yields a sulfur dioxide emission rate of 1.2 pounds per million Btu.

Under the law, utilities are permitted to take credit for sulfur that remains in bottom ash (ash remaining in the bottom of the furnace after the coal is burned). For example, if a utility is required to remove 90 percent of the sulfur in the coal and 3 percent remains in the ash, it has to remove only 87 percent using scrubbers. This credit is included in emissions data in this report. It is likely, however, that in many cases the credit is not taken. In order to take the ash credit, utilities need to monitor the coal consumed on a daily basis; this is both time-consuming and costly. To the extent that utilities do not take the ash credit, emissions might be slightly overstated.

Controlled Nitrogen Oxide Emissions. Although there are many techniques that utilities can use to reduce nitrogen oxides emissions, it is impractical to calculate the actual reductions achieved.[16] Consequently, two assumptions are made to determine controlled emissions of nitrogen oxides: all boilers subject to a nitrogen-oxides-emission standard will emit at a rate equal to the standard; and all boilers that are not subject to a standard will emit the quantity of nitrogen oxides determined by using Environmental Protection Agency emission factors. Accordingly, controlled nitrogen oxides emissions are determined by choosing the lesser of two numbers: the emission standard or the uncontrolled emissions rate.

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[16] Nitrogen oxides emissions are highly sensitive to many operating parameters that are not easily monitored.

A degree of complexity is added to this approach, however, because emission standards are not reported in consistent units. In some rare instances emission standards are reported in units that cannot be directly compared with estimated uncontrolled emission rates. Examples of such standards are ones that specify the concentration of nitrogen oxides allowed in the stack gas or the ambient quality concentration of nitrogen oxides (parts per million). In cases where these types of standards were reported, the uncontrolled emission rate was used. Such standards are very rare, however, and do not significantly affect the results.

Financial Indicators

The following formulas are used to calculate composite financial indicators.

Electric Fixed Asset (Net Plant) Turnover =

$$\frac{\sum_i (EO_i)}{\sum_i (U_i)},$$

where EO_i is the Electric Operating Revenue for the i^{th} major utility, and U_i is the Electric Utility Plant -- Net for the i^{th} major utility.

Total Asset Turnover =

$$\frac{\sum_i (O_i)}{\sum_i (A_i)},$$

where O_i is the Operating Revenue for the i^{th} major utility, and A_i are the Total Assets for the i^{th} major utility.

Current Assets to Current Liabilities =

$$\frac{\sum_i (CAA_i)}{\sum_i (CAL_i)},$$

where CAA_i are the Current and Accrued Assets for the i^{th} major utility, and CAL_i are the Current and Accrued Liabilities for the i^{th} major utility.

Long-Term Debt to Capitalization =

$$\frac{\sum_i (LTD_i)}{\sum_i (C_i)} \times 100,$$

where LTD_i is the Long-term Debt for the i^{th} major utility, and C_i is the Capitalization for the i^{th} major utility.

Preferred Stock to Capitalization =

$$\frac{\sum_i (PS_i)}{\sum_i (C_i)} \times 100,$$

where PS_i is the Preferred Stock for the i^{th} major utility, and C_i is the Capitalization for the i^{th} major utility.

Common Stock Equity to Capitalization =

$$\frac{\sum_i (CSE_i)}{\sum_i (C_i)} \times 100,$$

where CSE_i is the Common Stock Equity of the i^{th} major utility; and, C_i is the Capitalization for the i^{th} major utility.

Total Debt to Total Assets =

$$\frac{\sum_i (LTD_i + STD_i)}{\sum_i (A_i)} \times 100,$$

where LTD_i is the Long-term Debt of the i^{th} major utility; STD_i is the Short-term Debt of the i^{th} major utility; and, A_i are the Total Assets of the i^{th} major utility.

Common Stock Equity to Total Assets =

$$\frac{\sum_i (CSE_i)}{\sum_i (A_i)} \times 100,$$

where CSE_i is the Common Stock Equity of the i^{th} major utility; and, A_i are the Total Assets of the i^{th} major utility.

Interest Coverage Before Taxes
Without AFUDC =

$$\frac{\sum_i \left(\begin{array}{c} IBI_i + EIT_i + GIT_i \\ +OUIT_i + TOID_i - AC_i \end{array} \right)}{\sum_i (IE_i)},$$

where IBI_i is Total Income Before Interest Charges for the i^{th} major utility; EIT_i are the Electric Income Taxes for the i^{th} major utility; GIT_i are the Gas Income Taxes for the i^{th} major utility; $OUIT_i$ are the Other Utility Income Taxes for the i^{th} major utility; $TOID_i$are the Taxes for Other Income and Deductions for the i^{th} major utility; AC_i is the Allowance for Other Funds Used During Construction (AFUDC) for the i^{th} major utility; and, IE_i is the Interest Expense for the i^{th} major utility.

Profit Margin =

$$\frac{\sum_i (NI_i)}{\sum_i (O_i)} \times 100,$$

where NI_i is the Net Income of the i^{th} major utility; and, O_i is the Utility Operating Revenue for the i^{th} major utility.

Return on Average Common Stock Equity =

$$\frac{\sum_i (NI_i)}{\left(\sum_i (CSEB_i) + \sum_i (CSEE_i) \right) / 2} \times 100,$$

where NI_i is the Net Income of the i^{th} major utility; $CSEB_i$ is the Common Stock Equity at Beginning of Year, for the i^{th} major utility, and $CSEE_i$ is the Common Stock Equity at End of Year for the i^{th} major utility.

Return on Investment =

$$\frac{\sum_i (NI_i)}{\sum_i (A_i)} \times 100,$$

where NI_i is the Net Income of the i^{th} major utility; and, A_i are the Total Assets of the i^{th} major utility.

General Information

Use of the Glossary

The terms in the glossary have been defined for general use. Restrictions on the definitions as used in these data collection systems are included in each definition when necessary to define the terms as they are used in this report.

Obtaining Copies of Data

Upon EIA approval of the *Electric Power Annual*, the data are available for public use on a cost-recovery basis.

Computer listings are obtained for a charge by submitting a written request to:

Energy Information Administration, EI-541
Electric Power Division
Forrestal Building, Room 2F-049
Washington, DC 20585

These data are also available monthly on machine-readable tapes. Tapes may be purchased by using Visa, Master Card, or American Express cards as well as money orders or checks payable to the National Technical Information Service (NTIS). Purchasers may also use NTIS and Government Printing Office depository accounts. To place an order, contact:

National Technical Information Service (NTIS)
Office of Data Base Services
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
(703) 487-4650

Glossary

Acid Rain: Also called acid precipitation or acid deposition, acid rain is precipitation containing harmful amounts of nitric and sulfuric acids formed primarily by nitrogen oxides and sulfur oxides released to the atmosphere when fossil fuels are burned. It can be wet precipitation (rain, snow, or fog) or dry precipitation (absorbed gaseous and particulate matter, aerosol particles or dust). Acid rain has a pH below 5.6. Normal rain has a pH of about 5.6, which is slightly acidic. The term pH is a measure of acidity or alkalinity and ranges from 0 to 14. A pH measurement of 7 is regarded as neutral. Measurements below 7 indicate increased acidity, while those above indicate increased alkalinity.

Allowance for Funds Used During Construction (AFUDC): A noncash item representing the estimated composite interest costs of debt and a return on equity funds used to finance construction. The allowance is capitalized in the property accounts and included in income.

Ampere: The unit of measurement of electrical current produced in a circuit by 1 volt acting through a resistance of 1 ohm. (See Current, Ohm, Volt.)

Anthracite: Anthracite, or hard coal, is the highest rank of economically useable coal. It is jet black with a high luster. The moisture content generally is less than 15 percent. Anthracite contains approximately 22 to 28 million Btu per ton as received and averages about 25 million Btu per ton. Its ignition temperature is approximately 925 to 970 degrees Fahrenheit. Virtually all of the anthracite mined is from northeastern Pennsylvania. It is used mostly for space heating and generating electricity.

Ash: Impurities consisting of silica, iron, alumina, and other incombustible matter which are contained in coal. Ash increases the weight of coal, adds to the cost of handling, and can affect the burning characteristics. Ash content is measured as a percent by weight of coal on an "as received" or a "dry" (moisture-free, usually part of a laboratory analysis) basis.

Asset: An economic resource that is tangible or intangible and which is expected to provide benefits to a business.

Available but not Needed Capability: Net capability of main generating units that are operable but not considered necessary to carry load, and cannot be connected to load within 30 minutes. (See Capability, Standby Facility.)

Bbl: The abbreviation for barrel. (See Barrel.)

Bcf: The abbreviation for one billion cubic feet.

Barrel: A volumetric unit of measure for crude oil and petroleum products equivalent to 42 U.S. gallons.

Base Bill: A charge calculated by taking the rate from the appropriate electric rate schedule and applying it to the level of consumption. (See Electric Rate Schedule.)

Baseload: The minimum amount of electric power delivered or required over a given period of time at a steady state. (See Baseload Plant.)

Baseload Capacity: The generating equipment normally operated to serve loads on an around-the-clock basis. (See Baseload, Baseload Plant.)

Baseload Plant: A plant, usually housing high-efficiency steam-electric units, which is normally operated to take all or part of the minimum load of a system, and which consequently produces electricity at an essentially constant rate and runs continuously. These units are operated to maximize system mechanical and thermal efficiency and minimize system operating costs. (See Baseload.)

Bituminous Coal: Bituminous coal, or soft coal, is the most common coal. It is dense, black, often with well-defined bands of bright and dull material. Its moisture content usually is less than 20 percent. The heating value ranges from 19 to 30 million Btu per ton as received and averages about 24 million Btu per ton. The ignition temperature ranges from about 700 to almost 900 degrees Fahrenheit. Bituminous coal is mined chiefly in the Appalachian and Interior coal fields. It is used for generating electricity, making coke, and space heating.

Boiler: A device for generating steam for power, processing, or heating purposes; or hot water for heating purposes or hot water supply. Heat from an external combustion source is transmitted to a fluid contained within the tubes found in the boiler shell. This fluid is delivered to an end-use at a desired pressure, temperature and quality. (See Prime Mover.)

Btu (British Thermal Unit): A standard unit for measuring the quantity of heat energy equal to the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Capability: The maximum load that a generating unit, generating station, or other electrical apparatus can carry under specified conditions for a given period of time without exceeding approved limits of temperature and stress.

Capacity: The amount of electric power delivered or required for which a generator, turbine, transformer, transmission circuit, station, or system is rated by the manufacturer. (See Generator Nameplate Capacity.)

Capacity Charge: An element in a two-part pricing method used in capacity transactions (energy charge is the other element). The capacity (demand) charge is assessed on the amount of capacity being purchased. Also called Demand Charge.

Capital (Financial): The line items on the right side of a balance sheet, which include debt, preferred stock, and common equity. A net increase in assets must be financed by an increase in one or more forms of capital.

Census Divisions: The nine geographic divisions of the United States established by the Bureau of the Census, U.S. Department of Commerce for statistical analysis. The boundaries of Census divisions coincide with State boundaries. The Pacific Division is subdivided into the Pacific Contiguous and Pacific Noncontiguous areas.

Circuit: A conductor or a system of conductors through which electric current flows. (See Current.)

Coal: A black or brownish-black solid combustible substance formed by the partial decomposition of vegetable matter without access to air. The rank of coal, which includes anthracite, bituminous coal, subbituminous coal, and lignite, is based on fixed carbon, volatile matter, and heating value. Coal rank indicates the progressive alteration from lignite to anthracite. Lignite contains approximately 9 to 17 million Btu per ton. The contents of subbituminous and bituminous coal range from 16 to 24 million Btu per ton and from 19 to 30 million Btu per ton, respectively. Anthracite contains approximately 22 to 28 million Btu per ton. (See anthracite, bituminous coal, subbitumious coal, lignite)

Cogenerator: A generating facility that produces electricity and another form of useful thermal energy (such as heat or steam), used for industrial, commercial, heating, or cooling purposes.

Coincident Demand: The sum of two or more demands that occur in the same time interval. (See Demand.)

Coincident Peak Load: The sum of two or more peak loads that occur in the same time interval. (See Peak Load.)

Combined Cycle: An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Combined Pumped-Storage Plant: A pumped-storage hydroelectric power plant that uses both pumped water and natural streamflow to produce electricity.

Commercial Operation: Commercial operation begins when control of the loading of the generator is turned over to the system dispatcher.

Commercial Retail Prices of Electricity: The price of electricity supplied to commercial or business establishments such as stores, offices, restaurants, and garages for lighting and other power purposes.

Commercial Sector: The commercial sector is generally defined as nonmanufacturing business establishments, including hotels, motels, restaurants, wholesale businesses, retail stores, and health, social, and educational institutions. Utilities may classify commercial service as including all consumers whose demand or annual use exceeds some specified limit. The limit may be set by the utility based on the rate schedule of the utility.

Construction Work In Progress (CWIP): The balance shown on a utility's balance sheet for construction work not yet completed but in progress. This balance line item may or may not be included in the rate base.

Consumption (Fuel): The amount of fuel used for gross generation, providing standby service and start-up and/or flame stabilization. (See Fuel.)

Contract Cost: Price of fuels marketed on a contract basis covering a period of 1 or more years. Contract prices reflect market conditions at the time the contract was negotiated and therefore remain constant throughout the life of the contract or are adjusted through escalation clauses. Generally, contract prices do not fluctuate widely.

Contract Receipts: Purchases based on a negotiated agreement that generally covers a period of 1 or more years.

Cooperative (Cooperatively Owned Electric Utility): A group organized under the law into a utility company that will generate, transmit, and/or distribute supplies of electric energy to a specified area not being serviced by another utility. Such ventures are generally exempt from the Federal income tax laws. Most cooperatives have initially been financed by the U.S. Department of Agriculture's Rural Electrification Administration. (See Electric Power Industry.)

Cost: The amount paid to acquire resources such as plant and equipment, fuel, or labor services.

Current (Electric): A flow of electrons in an electrical conductor. The strength or rate of movement of the electricity is measured in amperes. (See Ampere, Ohm, Volt.)

Demand (Electric): The rate at which electric energy is delivered to or by a system, part of a system, or piece of equipment, at a given instant or averaged over any designated period of time.

Distillate Fuel Oil: A general classification for one of the petroleum fractions produced in conventional distillation operations. It is used primarily for space heating, on-and-off-highway diesel engine fuel (including railroad engine fuel and fuel for agriculture machinery), and electric power generation. Included are products known as No. 1, No. 2, and No. 4 fuel oils; No. 1, No. 2, and No. 4 diesel fuels.

Distribution System: The portion of an electric system that is dedicated to delivering electric energy to an end-user. (See System (Electric), Transmission.)

Diversity Exchange: An exchange of capacity or energy, or both, between systems whose peak loads occur at different times.

Electric Plant: A facility containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or fission energy into electric energy.

Electric Rate Schedule: A statement of the electric rate and the terms and conditions governing its application, including attendant contract terms and conditions that have been accepted by a regulatory body with appropriate oversight authority.

Electric Utility: An enterprise that is engaged in the generation, transmission, or distribution of electric energy primarily for use by the public and is the major power supplier within a designated service area. Electric utilities include publicly owned; cooperatively owned; and government-owned (municipals, Federal agencies, State projects, and public power districts) systems.

Energy: The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatthours, while heat energy is usually measured in British thermal units. (See Energy Source.)

Energy Charge: That portion of the charge for electric service based upon the electric energy (kWh) consumed or billed.

Energy Deliveries: Energy generated by one electric utility system and delivered to another system through one or more transmission lines. (See Wheeling Service.)

Energy Receipts: Energy generated by one electric utility system and received by another system through one or more transmission lines. (See Wheeling Service.)

Energy Source: The primary source that provides the power that is converted to electricity through chemical, mechanical, or other means. Energy sources include coal, petroleum and petroleum products, gas, water, uranium, wind, sunlight, geothermal, and other sources.

Equity Capital: The sum of capital from retained earnings and the issuance of stocks.

Expenditure: The incurrence of a liability to obtain an asset or service.

Facility: A location at which prime movers, electric generators, and/or equipment for converting mechanical, chemical, and/or nuclear energy into electric energy are situated. A facility may contain more than one type of prime mover. For cogenerators, the facility includes the industrial or commercial process.

Federal Energy Regulatory Commission (FERC): FERC is a quasi-independent regulatory agency within the Department of Energy having jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification.

Federal Power Act: Enacted in 1920, and amended in 1935, the Act consists of three parts. The first part incorporated the Federal Water Power Act administered by the former Federal Power Commission, whose activities were confined almost entirely to licensing non-Federal hydroelectric projects. Parts II and III were added with the passage of the Public Utility Act. These parts extended the Act's jurisdiction to include regulating the interstate transmission of electrical energy and rates for its sale as wholesale in interstate commerce. The Federal Energy Regulatory Commission is now charged with the administration of this law. (See Federal Energy Regulatory Commission).

Federal Power Commission: The predecessor agency of the Federal Energy Regulatory Commission. The Federal Power Commission was created by an Act of Congress under the Federal Water Power Act on June 10, 1920. It was charged originally with regulating the electric power and natural gas industries. It was abolished on September 30, 1977, when the Department of Energy was created. Its functions were divided between the Department of Energy and the Federal Energy Regulatory Commission. (See Federal Energy Regulatory Commission.)

FERC: The Federal Energy Regulatory Commission.

FERC Form 1: The "The Annual Report of Major Electric Utilities, Licensees and Others," collects financial and operational information from major privately owned electric utilities, licensees and others subject to the jurisdiction of the Federal Energy Regulatory Commission. Approximately 180 electric utilities submit this form based on sales and transmission service (for each of the 3 previous calendar years) exceeding one of the following thresholds: 1 million megawatthours of total annual sales, 100 megawatthours of annual sales for resale, 500 megawatthours of annual gross interchange out, or 500 megawatthours of wheeling for others (deliveries plus losses).

FERC Form 423: The "Monthly Report of Cost and Quality of Fuels for Electric Plants," collects data on the cost, quality, and sources of fuel. Approximately 225 electric utilities report for each plant having a fossil-fueled steam-electric nameplate capacity of 50 or more megawatts.

Firm Gas: Gas sold on a continuous and generally long-term contract.

Flue Gas Particulate Collectors: Equipment used to remove fly ash from the combustion gases of a boiler plant before discharge to the atmosphere. Particulate collectors include electrostatic precipitators, mechanical collectors (cyclones), fabric filters (baghouses), and wet scrubbers.

Flue Gas Desulfurization Unit (Scrubber): Equipment used to remove sulfur oxides from the combustion gases of a boiler plant before discharge to the atmosphere. Chemicals such as lime are used as the scrubbing media.

Forced Outage: The shutdown of a generating unit, transmission line or other facility, for emergency reasons or a condition in which the generating equipment is unavailable for load due to unanticipated breakdown.

Form EIA-759: The "Monthly Power Plant Report," collects monthly data from all electric utilities on net generation, consumption of coal, oil, and gas, and end-of-month stocks of coal and oil for each plant by prime mover and fuel-type combination. Approximately 800 electric utilities report. Form EIA-759 replaced the FPC Form 4 in January 1982.

Form EIA-767: The "Steam Electric Plant Operation and Design Report," collects data annually on plant operations and equipment design including boiler, generator, cooling system flue gas desulfurization, flue gas particulate collector, and stack data. Respondents are required to report for all plants with a fossil-fueled steam-electric nameplate capacity of 10 or more megawatts. Approximately 900 plants report. Form EIA-767 replaced the FPC Form 67 in 1982.

Form EIA-826: The "Monthly Electric Utility Sales and Revenue Report with State Distributions," collects monthly data on customers, sales, revenues, sales for resale, and other financial items. Approximately 225 electric utilities report.

Form EIA-860: The "The Annual Electric Generator Report," collects data from electric utilities in the United States on the status of electric power plants and associated equipment in operation within 10 years of the reporting year. Generator-specific data are reported by approximately 900 electric utilities.

Form EIA-861: The "The Annual Electric Utility Report," collects data on the source and disposition of energy, including net purchases, exchanges and wheeling, energy used by the electric department, energy furnished without charge, and energy losses, revenue, retail sales, sales for resale, and nonutility power production data. Form EIA-861 is a mandatory collection of data, filed annually by approximately 3,250 electric utilities in the United States, its territories, and Puerto Rico.

Fossil Fuel: Any naturally occurring organic fuel, such as petroleum, coal, and natural gas.

Fossil Fuel Plant: A plant using coal, petroleum, or gas as its source of energy.

Fuel: Any substance that can be burned to produce heat; also, materials that can be fissioned in a chain reaction to produce heat.

Fuel Expenses: These costs include the fuel used in the production of steam or driving another prime mover for the generation of electricity. Other associated expenses include unloading the shipped fuel, and all handling of the fuel up to the point where it enters the first bunker, hopper, bucket, tank, or holder in the boiler-house structure.

Full-Forced Outage: The net capability of main generating units that is unavailable for load for emergency reasons. (See Forced Outage, Standby Facility.)

Gas: (See Natural Gas.)

Gas Turbine Plant: A plant in which the prime mover is a gas turbine. A gas turbine consists typically of an axial-flow air compressor, one or more combustion chambers where liquid or gaseous fuel is burned and the hot gases are passed to the turbine; where the hot gases expand to drive the generator and then are used to run the compressor.

Generating Unit: Any combination of physically connected generator(s), reactor(s), boiler(s), combustion turbine(s), or other prime mover(s) operated together to produce electric power.

Generation: The process of producing electric energy by transforming other forms of energy; also, the amount of electric energy produced. (See Electric Plant, Energy.)

Generator: A machine that converts mechanical energy into electrical energy.

Generator Nameplate Capacity: The full-load continuous rating of a generator, prime mover or other electrical power production equipment under specified conditions as designated by the manufacture. Installed generator nameplate rating is usually indicated on a nameplate physically attached to the generator.

Geothermal Plant: A plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that derives its energy from heat found in rocks or fluids at various depths beneath the surface of the earth. The energy is extracted by drilling and/or pumping.

Gigawatt (GW): One billion watts. (See Watt.)

Gigawatthour (GWh): One billion watthours. (See Watthour.)

Greenhouse Effect: The increasing mean global surface temperature of the earth caused by gases in the atmosphere (including carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons). The greenhouse effect allows solar radiation to penetrate but absorbs the infrared radiation returning to space.

Grid: The layout of an electrical distribution system. (See Transmission, Transmission System, Electric)

Gross Generation: The total amount of electric energy produced by a generating facility as measured at the generator terminals. (See Generation, Electric Plant.)

Heavy Oil: The fuel oils remaining after the lighter oils have been distilled off during the refining process. Except for start-up and flame stabilization, virtually all petroleum used in steam plants is heavy oil.

Hydroelectric Plant: A plant in which the turbine generators are driven by falling water.

Industrial Retail Prices of Electricity: Price of the electricity supplied to industrial establishments such as automotive and steel producing industries.

Industrial Sector (Electricity): The industrial sector is generally defined as including manufacturing, construction, mining, agriculture, fishing, and forestry establishments Standard Industrial classified under Standard Industrial Classification (SIC) codes 01-39. The utility may classify industrial service using the SIC codes, or based on demand or annual usage exceeding some specified limit. The limit may be set by the utility based on its own rate schedule. Sales for consumers (i.e. farms and irrigation) that the utility has no system for separating into residential, commercial, and industrial classifications, should be classified based on the classification of consumer their rate most closely resembles. If there is no rate schedule distinction, utilities may define industrial consumers as those having a demand equal to or greater than 1,000 kilowatts.

Interdepartmental Service: Electricity supplied to departments of the electric utility company other than the electric generating department.

Intermediate Load: The range from base load to a point between base load and maximum peak. This point, which is dependent on the load curve, may be the midpoint, a percent of the peak load, or the load over a specified time period.

Internal Combustion Plant: A plant in which the prime mover is an internal combustion engine. An internal combustion engine has one or more cylinders in which the process of combustion takes place, converting energy released from the rapid burning of a fuel-air mixture into mechanical energy. Diesel or gas-fired engines are the principal types used in electric plants. The plant is usually operated during periods of high demand for electricity.

Interruptible Gas: Gas sold to customers with a provision that permits curtailment or cessation of service and at the discretion of the distributing company under certain circumstances as specified in the service contract.

Kilowatt (kW): One thousand watts. (See Watt.)

Kilowatthour (kWh): One thousand watthours. (See Watthour.)

Leverage Ratio: The ratio of total debt to total assets.

Liability: An amount payable in dollars or by future services to be rendered.

Light Oil: Lighter fuel oils distilled off during the refining process. Virtually all petroleum used in internal combustion and gas-turbine engines is light oil.

Lignite: Lignite, the lowest rank of coal, is brownish black and has a high moisture content, sometimes as high as 45 percent. It tends to disintegrate when exposed to the weather. The heat content of lignite ranges from 9 to 17 million Btu per ton as received and averages about 14 million Btu per ton. The ignition temperature is approximately 600 degrees Fahrenheit. Lignite is mined in California, Louisiana, Montana, North Dakota, and Texas, and is used mainly to generate electricity in power plants that are relatively close to the mines.

Load (Electric): The amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the customers.

Maximum Demand: The greatest of all demands of the load that has occurred within a specified period of time.

Mcf: One thousand cubic feet.

Megawatt (MW): One million watts. (See Watt.)

Megawatthour (MWh): One million watthours. (See Watthour.)

MMcf: One million cubic feet.

Natural Gas: A naturally occurring mixture of hydrocarbon and nonhydrocarbon gases found in porous geological formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

Net Generation: Gross generation less plant use, measured at the high-voltage terminals of the station's step-up transformer. The energy required for pumping at pumped-storage plants is regarded as plant use and must be deducted from the gross generation. (See Generation, Electric Plant.)

Net Summer Capability: The steady hourly output which generating equipment is expected to supply to system load exclusive of auxiliary power as demonstrated by tests at the time during summer peak demand.

Net Winter Capability: The steady hourly output which generating equipment is expected to supply to system load exclusive of auxiliary power as demonstrated by test at the time of winter peak demand.

Noncoincident Peak Load: The sum of two or more peak loads on individual systems that do not occur in the same time interval. Meaningful only when considering loads within a limited period of time, such as a day, week, month, a heating or cooling season, and usually for not more than 1 year.

Nonutility Power Producer: An enterprise that has electric generating capacity and is not an electric utility. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other nonutility generators (including independent power producers) without a designated franchised service area, and which are not otherwise required to file forms listed in the Code of Federal Regulations, Title 18, Part 141.

North American Electric Reliability Council (NERC): A council formed in 1968 by the electric utility industry to promote the reliability and adequacy of bulk power supply in the electric utility systems of North America. NERC consists of nine regional reliability councils and encompasses essentially all the power systems of the contiguous United States, Canada, and some in Mexico. The NERC Regions are:

ECAR - East Central Area Reliability Coordination Agreement

ERCOT - Electric Reliability Council of Texas

MAIN - Mid-America Interconnected Network

MAAC - Mid-Atlantic Area Council

MAPP - Mid-Continent Area Power Pool

NPCC - Northeast Power Coordinating Council

SERC - Southeastern Electric Reliability Council

SPP - Southwest Power Pool

WSCC - Western Systems Coordinating Council

Nuclear Fuel: Fissionable materials that have been enriched to such a composition that when placed in a nuclear reactor will support a self-sustaining fission chain reaction, producing heat in a controlled manner for process use.

Nuclear Power Plant: A plant in which the prime mover is a steam turbine. The steam used to drive the turbine is produced by a heat transfer from the reactor vessel during the period when the nuclear fuel is undergoing fission.

Off-Peak Gas: Gas which is to be delivered and taken on demand when demand is not at its peak. (See Spot Purchases.)

Ohm: The unit of measurement of electrical resistance. The resistance of a circuit in which a potential difference of one volt produces a current of one ampere. (See Ampere, Current, Volt.)

Operable: A unit is operable when it is available to provide power to the grid. For a nuclear unit, this is when it receives its full power amendment to its operating license from the Nuclear Regulatory Commission.

Other Service to Public Authorities: Electricity supplied to municipalities or divisions or agencies of State or Federal governments, under special contracts or agreements or service classifications applicable only to public authorities.

Outage: The period during which a generating unit, transmission line, or other facility is out of service. (See Forced Outage, Scheduled Outage.)

Peak Load: The maximum load during a specified period of time.

Peak Load Plant: A plant usually housing old, low-efficiency steam units; gas turbines; diesels; or pumped-storage hydroelectric equipment normally used during the peak-load periods.

Peaking Capacity: Capacity of generating equipment normally reserved for operation during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on an around-the-clock basis. (See Peak Load.)

Percent Difference: The relative change in a quantity over a specified time period. It is calculated as follows: The current value number has the previous value number subtracted from it, and this new number is divided by the absolute value of the previous value number; then this new number is multiplied by 100.

Petroleum: A mixture of hydrocarbons existing in the liquid state found in natural underground reservoirs, often associated with gas. Petroleum includes Fuel Oil 2, 4, 5, 6, topped crude, kerosene, and jet fuel. (See Petroleum (Crude Oil.))

Petroleum Coke: A residue, high in carbon content and low in hydrogen, that is the final product of thermal decomposition in the condensation process in cracking. This product is reported as marketable coke or catalyst coke. The conversion factor is 5 barrels (of 42 U.S. gallons each) per short ton.

Petroleum (Crude Oil): A naturally occurring, oily, flammable liquid composed principally of hydrocarbons. Crude oil is occasionally found in springs or pools but usually is drilled from wells beneath the earth's surface.

Plant Use: The electric energy used in the operation of a plant. Included in this definition is the energy required for pumping at pump-storage plants.

Plant-Use Electricity: The electric energy used in the operation of a plant. This energy total is subtracted from the gross energy production of the plant; for reporting purposes the plant energy production is then reported as a net figure. The energy required for pumping at pumped-storage plants is by definition subtracted, and the energy production for these plants is then reported as a net figure. (See Combined Pumped-Storage Plant, Pumped-Storage Hydroelectric Plant, Pure Pumped-Storage Hydroelectric Plant.)

Power: The rate at which energy is transferred. Electrical energy is usually measured in watts. Also used for a measurement of capacity. (See Capacity, Energy, Watt.)

Power Pool: An association of two or more interconnected electric systems to provide better system reliability and efficiencies.

Price: The amount of money or consideration-in-kind for which a service is bought, sold, or offered for sale.

Prime Mover: The motive force, eg. steam, engine, turbine or water that drives an electric generator.

Profit: The income remaining after all business expenses are paid.

Public Street and Highway Lighting Service: Electricity supplied for the purpose of lighting streets, highways, parks, and other public places; or for traffic or other signal system service, for municipalities, or other divisions or agencies of State or Federal governments.

Pumped-Storage Hydroelectric Plant: A plant that usually generates electric energy during peak load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the reservoir through a conduit to turbine generators located in a power plant at a lower level.

Purchased Power Adjustment: A clause in a rate schedule that provides for adjustments to the bill when energy from another electric system is acquired and its cost varies from a specified unit base amount.

Pure Pumped-Storage Hydroelectric Plant: A plant that produces power only from water that has previously been pumped to an upper reservoir.

Qualifying Facility: A cogeneration facility or small power production facility that is not more than 50 percent owned by electric utilities and meets certain standards as defined under Section 201 of the Public Utilities Regulatory Policies Act of 1978.

Railroads and Railways Service: Electricity supplied to railroads and interurban and street railways, for general railroad use, including the propulsion of cars or locomotives, where such electricity is supplied under separate and distinct rate schedules.

Rate Base: The value of property upon which a utility is permitted to earn a specified rate of return as established by a regulatory authority. The rate base generally represents the value of property used by the utility in providing service and may be calculated by any one or a combination of the following accounting methods: fair value, prudent investment, reproduction cost, or original cost. Depending on which method is used, the rate base includes cash working capital, materials and supplies, and deductions for accumulated provisions for depreciation, contributions in aid of construction, customer advances for construction, accumulated deferred income taxes, and accumulated deferred investment tax credits.

Ratemaking Authority: A utility commission's legal authority to fix, modify, approve or disapprove rates as determined by the powers given the commission by a State or Federal legislature. (See Regulation.)

Receipts: Purchases of fuel.

Regulation: A utility commission carries out its regulatory functions through rulemaking and adjudication. Under rulemaking, the utility commission may propose a general rule or regulation change. By law, it must issue a notice of the proposed rule and a request for comments is also made; the Federal Energy Regulatory Commission publishes this in the Federal Register. The final decision must be published. A utility commission may also work on a case-by-case basis from submissions from regulated companies or others. Objections to a proposal may come from the FERC or intervenors, in which case the proposal must be presented to a hearing presided over by an administrative law judge. The judge's decision may be adopted, modified, or reversed by the utility commissioners in which case those involved can petition for a rehearing, and may appeal a decision through the courts to the U.S. Supreme Court. (See Ratemaking Authority.)

Reserve Margin (Operating): The amount of unused available capability of an electric power system at peak load for a utility system as a percentage of total capability.

Residential Retail Prices of Electricity: Price of electricity supplied to residential customers for lighting, refrigeration, cooling, water heating, and other domestic uses.

Residential Sector: The residential sector includes private household establishments which consume energy primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, and clothes drying. The classification of an individual consumer's account, where the use is both residential and commercial, is based on principal use. Apartment houses are included.

Residual Fuel Oil: The topped crude of refinery operation; includes No. 5 and No. 6 fuel oils as defined in ASTM Specification D396 and Federal Specification VV-F-815C, Navy Special fuel oil as defined in Military Specification MIL-F-859E including Amendment 2 (NATO Symbol F-77), and Bunker C fuel oil. Residual fuel oil is used for the production of electric power, space heating, vessel bunkering, and various industrial purposes. Imports of residual fuel oil include "Imported Crude Oil Burned as Fuel."

Revenue: An increase in the assets of an organization or the decrease in liabilities during an accounting period, primarily from the organization's operating activities. This may include the sale of electricity, and earnings from interest, dividends, lease income and royalties. (See Asset and Liability)

Running and Quick-Start Capability: The net capability of generating units that carry load or have quick-start capability. In general, quick-start capability refers to generating units that can be available for load within a 30-minute period. (See Capability, Load (Electric), Net Summer Capability.)

Sales: The amount of kilowatthours sold in a given period of time; usually grouped by classes of service such as residential, commercial, industrial, and other. Other sales include public street and highway lighting, other sales to public authorities, sales to railroads and railways, and interdepartmental sales.

Sales for Resale: A type of wholesale sales covering energy supplied to other electric utilities, cooperatives, municipalities, and Federal and State electric agencies for resale to ultimate consumers. (See Wholesale Sales.)

Scheduled Outage: The shutdown of a generating unit, transmission line, or other facility, for inspection or maintenance, in accordance with an advance schedule. (See Forced Outage.)

Short Ton: A unit of weight equal to 2,000 pounds.

Spinning Reserve: That reserve generating capacity running at a zero load and synchronized to the electric system.

Spot Purchases: A single shipment of fuel or volumes of fuel, purchased for delivery within 1 year. Spot purchases are often made by a user to fulfill a certain portion of energy requirements, to meet unanticipated energy needs, or to take advantage of low fuel prices.

Stability: The property of a system or element by virtue of which its output will ultimately attain a steady state. The amount of power that can be transferred from one machine to another following a disturbance. The stability of a power system is its ability to develop restoring forces equal to or greater than the disturbing forces so as to maintain a state of equilibrium.

Standard Industrial Classification (SIC): A set of codes developed by the Office of Management and Budget, which categorizes business into groups with similar economic activities.

Standby Facility: A facility that supports a utility system and is generally running under no-load. It is available to replace or supplement a facility normally in service. (See Standby Service, Outage.)

Standby Service: Support service that is available as needed to supplement a customer, a utility system, or to another utility if a schedule or an agreement authorizes the transaction. The service is not regularly used. (See Standby Facility, Outage.)

Steam-Electric Plant (Conventional): A plant in which the prime mover is a steam turbine. The steam used to drive the turbine is produced in a boiler where fossil fuels are burned.

Stocks (Fuel): A supply of fuel accumulated for future use. This includes coal and fuel oil stocks at the plant site, in coal cars, tanks, or barges at the plant site, or at separate storage sites.

Subbituminous Coal: Subbituminous coal, or black lignite, is dull black and generally contains 20 to 30 percent moisture. The heat content of subbituminous coal ranges from 16 to 24 million Btu per ton as received and averages about 18 million Btu per ton. Subbituminous coal, mined in the western coal fields, is used for generating electricity and space heating.

Substation: Facility equipment that switches, changes, or regulates electric voltage. (See Transformer, Transmission.)

Switching Station: Facility equipment used to tie together two or more electric circuits through switches. The switches are selectively arranged to permit a circuit to be disconnected, or to change the electric connection between the circuits. (See Electric Plant, Substation, Transformer, Transmission.)

System (Electric): Physically connected generation, transmission, and distribution facilities operated as an integrated unit under one central management, or operating supervision.

Total Bill: An itemized statement of fees and charges that consists of the base bill plus State and local taxes and other charges. These charges can include environmental surcharges, franchise taxes, purchased power adjustments, fuel adjustments, and any other taxes passed onto the customer from State and local governments which are collected by the utility.

Transformer: An electrical device for changing the voltage of alternating current.

Transmission: The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers, or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer. (See Current, Energy, Power, Watt.)

Transmission System (Electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems. (See Transmission.)

Turbine: A machine for generating rotary mechanical power from the energy in a stream of fluid (such as water, steam, or hot gas). Turbines convert the kinetic energy of fluids to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

Uniform System of Accounts: Prescribed financial rules and regulations established by the Federal Energy Regulatory Commission for utilities subject to its jurisdiction under the authority granted by the Federal Power Act.

Volt: The unit of measurement of electric force or pressure. The electrical force that, if steadily applied to a circuit with a resistance of one ohm, will produce a current of one ampere. (See Ampere, Current, Ohm.)

Voltage Reduction: Any intentional reduction of system voltage by three percent or greater for reasons of maintaining the continuity of service of the bulk electric power supply system.

Watt: The electrical unit of power. The rate of energy transfer equivalent to one ampere flowing under a pressure of one volt at unity power factor.

Watthour (Wh): An electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for 1 hour.

Wheeling Service: The movement of electricity from one system to another over transmission facilities of intervening systems. Wheeling service contracts can be established between two or more systems.

Wholesale Sales: Energy supplied to other electric utilities, cooperatives, municipalities, and Federal and State electric agencies for resale to ultimate consumers.

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